DOCUMENT RESUME

ED 303 344 SE 050 326

| | |
|---|---|
| TITLE | Improving Research through Peer Review. |
| INSTITUTION | National Academy of Sciences - National Research Council, Washington, DC. Board on Agriculture. |
| SPONS AGENCY | Agricultural Research Service (DOA), Washington, D.C. |
| PUB DATE | 87 |
| GRANT | 59-32U4-5-38 |
| NOTE | 43p.; Prepared by the Committee on Peer Review Procedures. Forms in Appendix A contain small print. |
| AVAILABLE FROM | National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161 (NTIS order no. PB88-163571; $12.95 paper, $6.95 microfiche). |
| PUB TYPE | Reports - Evaluative/Feasibility (142) -- Viewpoints (120) |
| EDRS PRICE | MF01/PC02 Plus Postage. |
| DESCRIPTORS | Agriculture; *Evaluation Methods; *Federal Government; *Peer Evaluation; *Program Evaluation; *Research; Scientists |
| IDENTIFIERS | *Agricultural Research Service |

ABSTRACT

The Agricultural Research Service (ARS) is the primary research agency of the U.S. Department of Agriculture. ARS scientists conduct research into the applications of technology and basic knowledge concerning food and agricultural enterprises. Area offices and national staff evaluate these scientists' proposals for in-house research through a system of peer review. An ARS committee was appointed to examine the peer review system and to recommend possible improvements. This report presents the committee's findings and recommendations as well as background information to serve as an introduction. Appendices are listed under the following headings: (1) "Research Project Peer Review Form (ARS-415)"; (2) "The Six Major Objectives of the ARS Program Plan"; (3) "Other ARS Review Systems"; (4) "In-house Review in Other Federal Laboratories"; and (5) "In-house Review in Private Industry." (CW)

# Improving Research Through Peer Review

Committee on Peer Review Procedures
Used by the U.S. Department of Agriculture's Agricultural Research Service
to Evaluate Proposed In-House Research Projects

Board on Agriculture

National Research Council

NATIONAL ACADEMY PRESS
Washington, D.C. 1987

NOTICE: The project that is the subject of this report was approved by the Governing Board of the National Research Council, whose members are drawn from the councils of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. The members of the committee responsible for the report were chosen for their special competences and with regard for appropriate balance.

This report has been reviewed by a group other than the authors according to procedures approved by a Report Review Committee consisting of members of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine.

The National Academy of Sciences is a private, nonprofit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare. Upon the authority of the charter granted to it by the Congress in 1863, the Academy has a mandate that requires it to advise the federal government on scientific and technical matters. Dr. Frank Press is president of the National Academy of Sciences.

The National Academy of Engineering was established in 1964, under the charter of the National Academy of Sciences, as a parallel organization of outstanding engineers. It is autonomous in its administration and in the selection of its members, sharing with the National Academy of Sciences the responsibility for advising the federal government. The National Academy of Engineering also sponsors engineering programs aimed at meeting national needs, encourages education and research, and recognizes the superior achievements of engineers. Dr. Robert M. White is president of the National Academy of Engineering.

The Institute of Medicine was established in 1970 by the National Academy of Sciences to secure the services of eminent members of appropriate professions in the examination of policy matters pertaining to the health of the public. The Institute acts under the responsibility given to the National Academy of Sciences by its congressional charter to be an adviser to the federal government and, upon its own initiative, to identify issues of medical care, research, and education. Dr. Samuel O. Thier is president of the Institute of Medicine.

The National Research Council was organized by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purposes of furthering knowledge and advising the federal government. Functioning in accordance with general policies determined by the Academy, the Council has become the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in providing services to the government, the public, and the scientific and engineering communities. The Council is administered jointly by both Academies and the Institute of Medicine. Dr. Frank Press and Dr. Robert M. White are chairman and vice chairman, respectively, of the National Research Council.

Support for this project was provided by grant 59-32U4-5-38 from the Agricultural Research Service of the U.S. Department of Agriculture.

Available from:
Board on Agriculture
National Research Council
2101 Constitution Avenue N.W.
Washington, D.C. 20418

Printed in the United States of America

## COMMITTEE ON PEER REVIEW PROCEDURES

RICHARD S. NICHOLSON, *Chairman*, National Science Foundation
LEONARD W. DEWHIRST, University of Arizona
NORMAN HACKERMAN, Robert A. Welch Foundation
MAUREEN R. HANSON, Cornell University
RALPH W. F. HARDY, Boyce Thompson Institute and BioTechnica International, Inc.
EDGAR L. KENDRICK, U.S. Department of Agriculture (retired)
RUTH L. KIRSCHSTEIN, National Institutes of Health
RICHARD J. PATTERSON, North Carolina Biotechnology Center
DENIS J. PRAGER, MacArthur Foundation
RICHARD B. SETLOW, Brookhaven National Laboratory
LEO M. WALSH, University of Wisconsin
RONALD A. WALTERS, Los Alamos National Laboratory
BARBARA DONAHUE WEBSTER, University of California at Davis

*Staff*

PHYLLIS B. MOSES, *Project Officer*
JAMES E. TAVARES, *Associate Executive Director*
SUSANNE E. MASON, *Administrative Secretary*

## BOARD ON AGRICULTURE



† Term began January 1, 1987
*Term ended December 31, 1986

# Preface

The Agricultural Research Service (ARS) is the principal research agency of the U.S. Department of Agriculture (USDA). ARS scientists conduct research to increase basic knowledge and apply modern technologies to improve the nation's food and agricultural enterprises. This important research mission requires a dedicated staff working within a coordinated framework. The ARS carries out its objectives in its widespread network of laboratories staffed by scientists trained in the many disciplines that support agricultural research.

The laboratories are guided in their unique mission by congressional directives, the ARS's centralized National Program Staff, and the area offices that manage the ARS's geographic groups of research locations. Area offices and the National Program Staff evaluate their scientists' proposals for in-house research projects through a project peer review system. Peer scientists inside and outside the ARS analyze written project proposals for their scientific value, methodology, and mission relevance. The goal of this review system is to help raise the quality of ARS research.

The ARS administrator asked the Board on Agriculture of the National Research Council (NRC) to examine the project peer review system, assess its effectiveness, and recommend possible improvements. In response to this request, the NRC established

a committee that was knowledgeable and experienced regarding peer review, the conduct and management of research, and the ARS.

The committee met twice and spent considerable time interviewing ARS staff members. The committee received excellent cooperation from ARS staff members and was impressed with their presentations. In arriving at its findings and recommendations the committee relied mainly on the expertise of its members and on the interviews in addition to its review of a large volume of data, information, and statistics.

The committee's findings and recommendations, which form the substance of this report, are put forth to help the ARS realize the fullest possible benefits from peer review to its research efforts. The committee has also included background material on the ARS and peer review as an introduction. In addition, the appendixes describe selected peer review systems used to evaluate personnel and programs within tl ARS, other government agencies, and private industry.

RICHARD S. NICHOLSON
*Chairman*

# Acknowledgments

The committee greatly appreciates the aid of the U.S. Department of Agriculture's Agricultural Research Service (ARS) area directors, National Program Staff, and scientists who generously provided information and thoughtful commentary on ARS peer review procedures used to evaluate in-house research projects. The committee especially thanks those individuals who participated in its meetings in Washington: Glenn W. Burton, Gerald E. Carlson, Darrell Cole, Gary H. Heichel, Virginia H. Holsinger, Terry B. Kinney, Dan Laster, William L. Ogren, H. Graham Purchase, William F. Rochow, William H. Tallent, and Lila O. Vodkin.

The committee acknowledges the constructive role of Board on Agriculture staff members Phyllis B. Moses, project officer; James E. Tavares, associate executive director; and Susanne E. Mason, administrative secretary, in gathering background information for the study and organizing the committee meetings and final report. The committee also thanks Grace Jones Robbins, assistant editor, for editing the report.

# Contents

# 1
# Introduction

## THE AGRICULTURAL RESEARCH SERVICE

### ARS Mission and Objectives

The Agricultural Research Service (ARS) is the principal in-house scientific research agency of the U.S. Department of Agriculture (USDA). ARS scientists conduct R&D on food and agricultural problems of broad scope and high national priority. ARS research is primarily mission- and problem-oriented. ARS programs include basic research as well as applied R&D. The congressional appropriation to the ARS for fiscal year 1986 was $509.7 million, much of it earmarked for research on specific commodities and agricultural problems. ARS research must be consistent with mandates established by Congress and responsive to the needs of the USDA, other government agencies, private trade organizations, and other users. The six major objectives of the ARS program plan are listed in Appendix B (ARS, 1983).

## ARS Organization

The administrator takes ultimate responsibility for ARS programs. The National Program Staff is responsible for overall program direction and allocation of funds for specific research programs and projects. The National Program Staff includes about 31 senior scientists representing many fields of agricultural research. These national program leaders report to two associate deputy administrators and the National Program Staff deputy administrator for programs. These administrators determine fund distributions within and among commodities, program plan categories, and research projects subject to the constraints of congressional mandates. The administrators' approval is needed for research projects.

The ARS's 127 research locations are geographically distributed among eight area offices: North Atlantic, Beltsville, South Atlantic, Midsouth, Midwest, Southern Plains, Northern Plains, and Pacific West. An area director is in charge of each location. Among other duties, area directors are responsible for conducting the project peer review process within their areas. There are approximately 1,600 in-house, appropriated ARS research projects; 20 to 25 percent of these are completed each year. Thus, normal project turnover provides opportunities for redirection of research.

The ARS employs more than 8,500 people full-time. Scientists and engineers represent about 35 percent of this work force; research technicians and support staff, about 65 percent. The staff are customarily granted permanent appointments or tenure after one year of service. The attrition rate of scientists is 3 to 5 percent annually. The ARS management therefore has the opportunity to fill about 100 posts each year with scientists skilled in new areas important to the ARS mission.

A senior investigator or research leader directs each research project. Each research leader prepares an annual resource management plan that must be approved by his or her area director, the National Program Staff, and the ARS administrator. The National Program Staff, leading scientists, and other experts continually assess national research priorities to ensure national coordination and program balance (ARS, 1985a).

The National Program Staff maintains a computerized ARS Research Project System, which works with the Cooperative State Research Service's Current Research Information System (CRIS).

These systems constitute a centralized on-line information source documenting agricultural and forestry research projects in the U.S. Department of Agriculture, state agricultural experiment stations, and schools of forestry and veterinary medicine. An important use of CRIS by the ARS is to track fund allocations among research projects. These research projects are referred to as CRIS work units.

## PEER REVIEW IN THE ARS

### Roles of Peer Review

Peer review of science is the evaluation of the conceptual and technical soundness of research by those qualified to judge it by their status in the same or closely related research fields. Scientific peer review originated in the evaluation and approval of manuscripts before their publication (Garfield, 1986; Zuckerman and Merton, 1971). The practice of reviewing manuscripts was instituted to preserve the credibility of scientists and their institutions and ensure the quality of published literature.

Peer review was subsequently adopted to assess grant proposals, scientific programs, and scientists. This evaluative mechanism is based on the premise that scientific peers, by virtue of their knowledge and experience, are best able to critically examine proposed or completed research projects and give scientific opinions concerning the projects' merit, significance, and feasibility.

Federal granting agencies that make extramural awards closely couple peer review of research proposals to allocation of research funds. These agencies include the National Science Foundation (NSF), the National Institutes of Health (NIH), and the USDA Competitive Research Grants Office. The exact mechanics of the review and decision-making processes vary somewhat in these and other such agencies, but their intent is the same — to allocate resources fairly in support of high-quality science in relevant fields.

These granting systems are competitive. Peer reviewers judge the scientific merit of proposed research projects and usually consider additional factors such as the scientist's past performance and the personnel and resources available to the laboratory. Reviewers generally assign a priority score indicative of their assessment of the proposal relative to competing proposals. Agency program

directors use the reviews to judge whether or not the proposal merits the agency's support.

Peer review in granting agencies is largely prospective. That is, proposed research projects are prejudged on their likely scientific and technical merit, importance, and success. Reviewers do consider retrospective aspects, however, such as the quality and quantity of the investigator's previous scientific output. In contrast, other peer review systems are primarily retrospective. Such systems include personnel evaluations for promotion and tenure.

Considerations other than scientific excellence may enter into review processes. Such processes are collectively called merit review to indicate that other factors carry some weight. These factors may include nontechnical policy considerations. One consideration may be the utility and relevance of research to a goal extrinsic to the research project itself, such as new or improved technology development or the solution of social problems. Another may be the impact on the infrastructure of science such as quality, distribution, or effectiveness of research, education, and manpower. Additional factors may sometimes pertain, such as the relevance to mission-oriented goals of a sponsor, research site selection, or interdisciplinary character of some areas of science (NSF, 1986).

The role of peer review is most predominant in assessing research proposals from single principal investigators. These projects are known as "small science." In contrast, large, complex, expensive, "big science" projects, such as the National Center for Atmospheric Research or the Fermi Accelerator, must pass the hurdles of technical scrutiny (peer review) and societal considerations (merit review). Most ARS research projects are conducted by single principal investigators managing small research teams, which is also common in universities. In this context ARS carries out small science. Therefore, technical peer review is sufficient for ARS projects. Before it appropriates funds, Congress has already considered the societal aspects of ARS scientific research.

Federal agencies review their in-house or intramural research programs by various mechanisms. Outside advisory groups review NIH intramural programs by conducting retrospective evaluations of individual laboratories and their scientists. The advisory groups transmit formal reports to NIH top management. These reports influence promotion, tenure, and resource allocation. The Department of Energy (DOE) National Laboratories assess programs and

projects by several prospective and retrospective methods. Private industry uses various types of review for planning, assessment of progress, and personnel evaluation. Information on several federal agency and industry internal review systems is included in Appendixes D and E. A key feature of many of these systems is a direct linkage to resource allocation.

## Evaluative Role of Peer Review Within ARS

The ARS uses peer review in several ways: to examine the quality of specific research projects, assess its national research programs, and evaluate its research personnel. The ARS project peer review system is outlined in the next section. The ARS review systems for programs and personnel are described in Appendix C. These three review systems are not directly linked to each other.

Project peer reviews do not directly influence whether or at what levels ARS research projects are funded. The National Program Staff's stated goal for the ARS project peer review system is to improve the quality of research already requested and funded by the federal government. The noncompetitive funding process of ARS laboratories differs from that of many university laboratories, which must obtain the majority of their research funds from competitive, peer-reviewed government granting programs. In addition, ARS science is ission-oriented and conducted mainly by tenured government scientists. Nevertheless, project peer review is quite applicable to the continuum of basic, developmental, and applied research that the ARS conducts. Moreover, peer review of in-house government-funded research can be effectively integrated with processes of resource allocation, as in the NIH intramural research program reviews (see Appendix D).

## ARS Peer Review System for In-House Projects

ARS review procedures for in-house projects are linked to CRIS documentation, which tracks all ARS research projects (ARS, 1985b). Thus, project statements that ARS scientists prepare for review are related to standard forms they submit to the National Program Staff for updating its computerized ARS Research Project System. Ongoing projects must have their project statements rewritten and rereviewed every five years.

The project review process begins with discussion among the

scientist, his or her research leader, area director, and national program leader. The discussion leads to an informal understanding on the proposed content of the research project. In the case of newly appropriated as opposed to continuing funds, the associate deputy administrator writes a letter of instruction to the research leader identifying funds and objectives. Projects must fit within the problem statements of the ARS National Program Plan (ARS, 1985a).

The scientist prepares a detailed project statement for peer review. There is no prescribed format. Individual statements vary greatly in length, from three-page summaries to fifteen-page (or longer) project proposals. The longer proposals may be modeled on formats that competitive granting agencies such as the NSF and the USDA Competitive Research Grants Office use. The project statement generally covers the project's objectives, justification, research approach, and a literature review. Details of the project's resources, personnel, and budget are not required; only its total annual budget is indicated. Descriptions of the scientist's past research accomplishments and publications are not routinely included.

The scientist submits the project statement and a list of six suggested reviewers to the area office. The area office selects three or more reviewers from this list and from other sources. Reviewers may be from inside or outside the ARS. The area office mails the project statement and the ARS research project peer review form (see Appendix A) to its selected reviewers. The area office evaluates the completed reviews and forwards them to the scientist. The area office may or may not forward reviews anonymously. The scientist must modify the project statement in accordance with the area office evaluation or otherwise respond to the reviewers' comments with a written statement.

The scientist fills out ARS research project summary forms (AD-416 and AD-417; ARS, 1985b). The area director must approve the final project statement and summary forms. Only the summary forms are forwarded to the National Program Staff for review, approval, and entry into the CRIS computer. The scientist submits brief annual progress reports to the National Program Staff (CRIS form AD-421; ARS, 1985b).

The ARS project review system operates entirely prospectively. Site visits are not conducted in conjunction with these project reviews. (The National Program Staff does periodically

visit ARS locations, however. See Appendix C.) Project reviews do not bear on the distribution of funds to ARS research projects, nor directly affect hiring, promotion, or tenure of ARS scientists. (ARS scientists are reviewed by their peers through an entirely separate Research Position Evaluation System; see Appendix C.)

# 2
# Findings and Recommendations

## THE COMMITTEE'S VIEW

The committee notes that peer review is not a precise term; it means different things in different contexts. For example, in their extramural research grants programs, the NIH and the NSF use peer review as the primary method to assess the scientific merit of competing research proposals. In this context, peer review is critical in deciding which proposals will or will not be funded. On the other hand, the ARS states that it uses peer review to improve the quality of research projects that it is funding or intends to fund to meet its mandated responsibilities. The committee supports this goal and the use of peer review to achieve it. The committee believes, however, that the ARS project peer review system needs to be strengthened to be effective.

The ARS should be aware of the different meanings of peer review. It should articulate the goals of its project peer review system and the uses of the reviews. The project peer review system is only one of several systems the ARS uses to emphasize excellence in achieving its mission. In principle, all of these are complementary, but in practice they do not seem to be. The committee believes it is essential that the ARS treat project peer review as one very important part of the larger system.

## PRINCIPAL CONCLUSIONS

The committee finds a lack of understanding and agreement among ARS staff regarding the purpose, use, and effect of the project peer review system. Many staff members also believe the system has no real impact on ARS research. As a result, some view it more as busy work than a substantive review of real or potential value to ARS scientists and, ultimately, to the ARS. This view seems logical because it appears the results of project peer review have no direct bearing on decisions affecting project funding, staff promotion, and merit pay increases.

Moreover, there is inadequate understanding within the ARS regarding how the ARS administrator balances and optimizes the dual objectives of scientific excellence and mission relevance and how project peer review is used in the context of these objectives. The committee believes the National Program Staff, area directors, research leaders, and research scientists need to understand and communicate better about the goals of project peer review, its implementation, and its impact on ARS science and scientists.

The committee also perceives a great need to have more visible incentives in the project peer review system. The staff must perceive that they will receive tangible rewards from full participation in the system and from exemplary peer reviews. This leads to the committee's principal recommendation.

***The ARS administrator should strengthen and reinforce the credibility and relevance of the project peer review system by linking the system's outcomes to incentives and disincentives that all ARS staff recognize and understand.***

In its discussions the committee identified several mechanisms to implement this recommendation:

- Better communication by the administrator of the incentives and disincentives that already exist;
- Coupling of project peer review results with budget allocations to research scientists and programmatic decisions of the National Program Staff;
- Integration of peer review results with the ARS Research Position Evaluation System and with decisions related to merit pay increases and bonuses;
- Correlation of exemplary peer reviews with allocation of resources, such as special equipment funds, increased staffing,

discretionary funds, travel, sabbaticals, and the ARS Postdoctoral Research Associate Program; and

- Allocation of some research funds in identified mission areas through *competition* based on the outcome of peer review. This necessarily implies that not all competitors will receive such funds.

The committee does not regard this as an exhaustive list and urges ARS top management to identify additional mechanisms.

## ADDITIONAL FINDINGS AND RECOMMENDATIONS

### Management

***The research management role of area directors should be strengthened. They should be responsible for the success of their researchers, and they should identify and reward top performers. The committee endorses the current discretionary fund for this purpose, but believes the size of this fund is inadequate. In addition, area directors should have control over some of the mechanisms recommended above.***

Area directors and research leaders occupy key positions in determining the success of the peer review system. Success in scientific research depends greatly on the research environment and thus on the skill and wisdom of these managers. It is essential, therefore, that these supervisors have the authority, responsibility, and tools to manage the scientific excellence and productivity of their staff.

### Selection and Evaluation of Peer Reviewers

***The ARS should develop a system to permit identification and use of reviewers in addition to those selected by the investigator. A reasonable number of these reviewers should be from outside the ARS.***

Currently, an ARS scientist provides a list of peer reviewers for his or her proposal. The area director's staff makes the final selection from the list. This practice is contrary to that practiced elsewhere. It is a potential source of criticism and bias that could undermine the credibility of the project peer review system.

***The ARS should implement additional procedures, such as the use of advisory committees, to assist in identification of appropriate proposal reviewers and conduct periodic oversight reviews.***

Related to this issue is the fact that the technical breadth of ARS projects makes it difficult for the small staff that manages the system at the area director level to make informed scientific judgments in many cases. The committee believes there are other ways of conducting peer review that might overcome these problems. For example, the area director could have an advisory committee whose members would be consulted for names of appropriate reviewers. In addition, such a committee could conduct periodic oversight reviews of the entire process. The committee believes, however, that it may be difficult to institute such a major change for all of the ARS. It may be desirable to have one of the areas experiment with this alternative at first.

## Uniformity

***A policy and procedure manual should be written to standardize operations and accountability.***

Because judgment is involved in peer review, some flexibility and diversity are desirable. There should be a standard set of procedures and recordkeeping in all areas, however. The committee also believes that uniform deadlines for the submission of project statements should be established throughout the ARS.

## Project Statements

***The ARS should provide a set of guidelines for preparation of project statements. These would include instructions about the length, scope, content, and organization of the proposals.***

There is great variability in the amount of detail and format of project statements. In some cases, insufficient documentation may preclude adequate peer review.

## Performance

***All project statements should include a record of the investigator's recent publications, past progress, and other accomplishments. Peer reviewers should be asked to comment on the likelihood that the***

***proposed research could be carried out successfully considering the scientist's past and current performance.***

When a scientific research proposal is judged, the past and present performance of the scientist who submitted the proposal can be as decisive a factor as the proposed research itself. Such information is not currently included as part of the proposal and not considered by the reviewers. The committee believes that it should be.

### Reviewer Anonymity

***The ARS should determine and clarify its policy regarding reviewer anonymity.***

There is some misunderstanding and disagreement among ARS staff regarding the anonymity of peer reviewers. Most peer review systems protect reviewers' anonymity; this protection presumably increases candor. The committee supports reviewer anonymity or a modified procedure whereby reviewers are given the option of anonymity.

### Research Project Peer Review Form

***The research project peer review form (ARS-415) should be revised and replaced with a much less structured one. Reviewers should only be asked to comment on the merit of the proposed research, whether it duplicates other work, and the likelihood that the investigator could conduct it successfully considering his or her recent accomplishments. Reviewers also should be asked to recommend improvements in the research.***

ARS staff are generally dissatisfied with the reviewer form (ARS-415) because it is highly structured and asks for often irrelevant information. (See Appendix A.)

### Reviewer Instructions

***It should be clearly explained to peer reviewers that their role is to review proposed research on a problem that the ARS has already selected as essential to meet its mission.***

ARS staff often do not fully understand the ARS's dual objectives of scientific excellence and mission relevance and how peer

review is used in the context of these objectives to promote excellence in research projects. Reviewers unfamiliar with the ARS are even more likely to lack appreciation of the ARS's goal to balance and optimize these objectives.

## RELATED OBSERVATIONS AND RECOMMENDATIONS

### Laboratory Site Visits

***The ARS should increase its use of laboratory site visits as a mechanism for reviewing the scientific merit of ongoing research projects and should involve ARS staff and outside peer reviewers as part of the site visit team.***

The project peer review system operates in the context of several other review systems. One of these is periodic site visit reviews of laboratories by ARS staff, including the National Program Staff. The committee endorses this process but believes that it would be enhanced if the site visit teams included outside peer reviewers. Other agencies such as the NSF and the DOE National Laboratories have found site visits especially valuable for more complex research programs involving several investigators. As the ARS consolidates the number of CRIS units and encourages more interdisciplinary, collaborative research, the importance of this form of peer review may increase.

### Tenure

***The ARS should seek legislative or administrative permission to employ nontenured research scientists for periods greater than one year. A longer time frame would enable the ARS to evaluate the research capabilities of these scientists and choose only the best as tenured ARS researchers. An excellent model is the NIH's Intramural Staff Fellowship program.***

Competent judgment of individual creativity takes more than one year. In universities. five to six years are typically required before a scientist is considered for tenure. Thus, a system where tenure decisions must be based on a single year's experience is counter to the goals of the ARS.

## Advisory Council

The committee endorses the recommendation of the 1985 NRC report *New Directions for Biosciences Research in Agriculture: High Reward Opportunities* that a research advisory council reporting to the administrator be established. An important function of this council could be oversight of the peer review system.

# References


Agricultural Research Service. 1983. Agricultural Research Service Program Plan (1429`. Washington, D.C.: U.S. Department of Agriculture.

Agricultural Research Service. 1985a. Agricultural Research Service Program Plan: 6-Year Implementation Plan, 1986-1992. Washington, D.C.: U.S. Department of Agriculture.

Agricultural Research Service. 1985b. Research Project Documentation Manual. Washington, D.C.: U.S. Department of Agriculture.

Agricultural Research Service. 1987. ARS Research Position Evaluation System Handbook. Washington, D.C.: U.S. Department of Agriculture.

Garfield, E. 1986. Refereeing and peer review. Part 1. Opinion and conjecture on the effectiveness of refereeing. Current Contents 31:3-11.

National Research Council. 1985. New Directions for Biosciences Research in Agriculture: High Reward Opportunities. Washington, D.C.: National Academy Press.

National Science Foundation. 1986. Final Report: NSF Advisory Committee on Merit Review. Washington, D.C.: National Science Foundation.

Zuckerman, H., and R. K. Merton. 1971. Patterns of evaluation in science: Institutionalisation, structure and functions of the referee system. Minerva 9:66-100.

# APPENDIXES

A
Research Project
Peer Review Form (ARS-415)

AGRICULTURAL RESEARCH

# RESEARCH PROJECT PEER REVIEW

**A—** **Project Data and Peer Review Type** – To be completed by Research Leader prior to solicitation of peer review.

## PROJECT DATA

| PROJECT TITLE: | PROJECT NO. | DATE |
|---|---|---|
| | | |

## REVIEW TYPE

AR or Non-AR Scientist ☐ AR Technical Advisor ☐ National Program Staff Coordinator ☐ Biometrician ☐

**B—** **Scientific Merit Review Criteria**

To be completed by all peer reviewers. Both qualitative ratings and narrative comments desired in spaces indicated; responses may be omitted on criteria peer reviewer does not feel qualified to address. Use additional sheets as necessary to provide responses.

**1. Overall scientific value of proposed research project:** Will the proposed project make a significant contribution to new knowledge, provide a better understanding of existing knowledge, develop appropriate new methodologies, or make valid contribution(s) to new technologies?

| *(Check one)* | | | | |
|---|---|---|---|---|
| Low | below | Average | above | High |
| | | | | |

NARRATIVE *(Please provide comments and explanation of rating)*:

**2. Adequacy of the research proposal design:** Is the proposal adequate and scientifically feasible with respect to the hypothesis, approach, and plan of work? Is the experimental design statistically sound?

| *(Check one)* | | | | |
|---|---|---|---|---|
| Low | below | Average | above | High |
| | | | | |

N VE *(Please provide explanation of rating and suggestions for improvements)*:

**3. Adequacy of literature review and knowledge:** Does the project statement provide an adequate review of the literature and demonstrate an appropriate awareness of the current state of the art?

| (Check one) | | | | |
|---|---|---|---|---|
| Low | below | Average | above | High |
| | | | | |

**NARRATIVE** *(Please provide comments and explanation of rating).*

**4. Adequacy of methods, equipment and personnel proposed:** Are the proposed methodologies, equipment and personnel appropriate and sufficient to accomplish the objective?

| (Check one) | | | | |
|---|---|---|---|---|
| Low | below | Average | above | High |
| | | | | |

**NARRATIVE** *(Please provide comments and explanation of rating)*

**5. Appropriateness of proposed timeframe:** Can the objective(s) be reached within the timeframe of the proposal and what is the probability of success? Can the objectives be restated so as to be achieved in the stated timeframe?

**NARRATIVE** ***(Please provide explanation of rating and suggestions for improvements)***:

| *(Check one)* | | | | |
|---|---|---|---|---|
| Low | below | Average | above | High |
| | | | | |

**6. Scientific importance of the proposal and its relationship to ongoing research:** What is the degree of scientific relevance and urgency of the proposed research and will the results contribute materially to the success of other ongoing projects:

**NARRATIVE** ***(Please provide explanation of rating and suggestions for improvements)***:

| *(Check one)* | | | | |
|---|---|---|---|---|
| Low | below | Average | above | High |
| | | | | |

**7. Extent of duplication of any (State, Federal or private) ongoing effort:** Does the project as proposed duplicate any (State, Federal or private) ongoing research or is it repetitive of previous research? If so, is this duplication/repetition desirable?

**8. Relative proportion of basic, applied and developmental research:** In the opinion of the peer reviewer, what percentage of the proposed research **is basic** in nature, what percentage **is applied**, in nature, and what percentage **is developmental** in nature?

**C– Program Merit Review Criteria**

To be completed by NPS reviewer and by other peer reviewers who feel qualified to address the criteria and questions.

**1.** Fit of proposed project to research priorities?

2. Need for research within context of National Research Programs, Technological Objectives, and USDA-ARS missions and goals?

3. Feasibility of completing the proposed research and achieving the objectives within the timeframe of the "need"?

4. Judgment of the cost/benefit of the proposed research? Adequacy of the funds and personnel requirements and facilities proposed?

5. Adequacy of the beneficiaries identified for the proposed project? *(Are the clientele and beneficiaries of this research properly identified? Are they appropriate to ARS missions and goals.*

**D— Peer Reviewer Information (Will be provided to project leader unless specified to the contrary by peer reviewer.)**

| NAME | ADDRESS |
|---|---|
| TITLE | |
| SIGNATURE | |
| DATE | TELEPHONE NO. |

# B
# The Six Major Objectives of the ARS Program Plan

The ARS Program Plan states six major objectives (ARS, 1983). The 1986 distribution of funds for the plan is shown in parentheses (ARS, 1985a). The objectives and fund allocations guide the mission and focus of ARS research.

1. Maintaining and increasing the productivity and quality of crop plants (39%).
2. Increasing the productivity of animals and the quality of animal products (19%).
3. Achieving maximum use of agricultural products for domestic markets and export (19%).
4. Managing and conserving soil and water resources (13%).
5. Promoting human health through improved nutrition and family resource management (8%).
6. Integrating scientific knowledge of agricultural production, processing, and marketing into systems that promote resource management and transfer of technology to users (2%).

# C
# Other ARS Review Systems

## ARS RESEARCH POSITION EVALUATION SYSTEM

The ARS uses a combination of the *Federal Research Grade Evaluation Guidelines* issued by the Office of Personnel Management and its own related policies to review its scientists for promotion and tenure. The *ARS Research Position Evaluation System Handbook* (ARS, 1987) documents this system. The scientist under review writes a description of his or her duties, responsibilities, qualifications, and scientific achievements. The scientist's research leader and area director must approve this document. The ARS personnel division chooses a seven-person in-house review panel that includes one person from management, one person from personnel, and five peer scientists to evaluate and rate the scientist. Final panel decisions are based on consensus and released in a written report. The report includes observations, recommendations, and a rating that establishes the scientist's grade. The scientist and his or her supervisor then discuss the rating. ARS scientists, ARS management, and persons in other federal agencies highly regard the ARS Research Position Evaluation System.

## ARS PROGRAM REVIEWS

The National Program Staff conducts formal and informal ARS site visits to review programs and obtain information needed for National Program Staff decisions on allocation of ARS resources. The National Program Staff organizes and leads the formal reviews. In general, the National Program Staff identifies a program area or specific location for review and invites participation by its national program leaders in that field of research, the area director, research leaders, and other appropriate managers and scientists from ARS. Occasionally, the National Program Staff asks non-ARS scientists who are employed at universities and industries and who are experts in the field of science under review to participate. Specialists from agencies inside or outside the USDA (for example, the Soil Conservation Service or the Environmental Protection Agency), who represent the user community, may also participate. The review team, which a national program leader generally chairs, writes a report based on the site visit. The National Program Staff headquarters, the area office, and the research leader under review use the review team's findings.

ARS program reviews are primarily focused on evaluating the progress of research programs and as such are retrospective reviews. The National Program Staff can use information from program reviews as one form of input to change national research approaches or objectives, redirect funds and personnel from one project or location to another, and terminate or initiate CRIS project work units. The National Program Staff strives to visit a quarter of the ARS locations each year. On the average, then, a particular laboratory would be visited every four or five years.

# D
# In-House Review in Other Federal Laboratories

## NATIONAL INSTITUTES OF HEALTH

Each of NIH's institutes that has an intramural research program also has an advisory group called a Board of Scientific Counselors. The board is responsible for retrospective review of the particular institute's laboratories. Each board consists of 12 to 15 senior scientists from academic institutions throughout the United States. A particular board's members have expertise in disciplines matched to the research activities of the institute they review. A board is often assisted by outside consultants with special expertise.

A board reviews a given laboratory within an institute about once every three years. Reviews are conducted through site visits, during which the laboratory scientists present their studies to the board members. Laboratory senior scientists as well as more junior postdoctoral fellows who are being considered for tenure are expected to defend their work during questioning by and discussion with the board and its consultants. The laboratory chief is responsible for the overall presentation of the work in the laboratory.

Based on the site visit, the board evaluates the scientific merit of the laboratory projects; decides whether the laboratory has an

appropriate amount of funds, space and personnel; recommends junior professional staff to be considered for tenure; and assesses whether the laboratory chief provides sufficient overall leadership, support, and advice. The board writes a report on the laboratory activities and personnel and makes specific recommendations. The board gives this report to the scientific director of the intramural program of the particular institute, the director of that institute, and the deputy director for NIH intramural programs. The board's recommendations form a basis for internal NIH recommendations regarding allocation of space, funds, and personnel slots; promotions for senior staff; and tenure plans for junior staff.

It should be pointed out that postdoctoral fellows may serve in that role for no more than seven years. After that time, they must leave if they have not been recommended for tenure. If tenure will not be granted, a scientist receives a one-year notice. Only about one in ten postdoctoral fellows receives tenure.

## DEPARTMENT OF ENERGY

Programs at the DOE National Laboratories are reviewed in several ways to assess individual research projects and group efforts. Various DOE offices conduct DOE review to examine scientific programs and laboratories. Although different offices share many features of DOE review, the details of their procedures vary. DOE review includes laboratory site visits, prospective review of individual project proposals and new initiatives, and retrospective review of existing programs. These reviews are considered in the DOE's budget planning and allocation process.

The DOE's Office of Health and Environmental Research and Office of Basic Energy Sciences support most of the biological research at DOE laboratories. These offices use similar review processes. Principal investigators must document their existing programs in yearly progress reports, which also include projections for coming fiscal years. These reports serve as budget requests to the DOE; they form the basis for the DOE's own federal budget request. In addition, outside site visit review teams examine the DOE's scientific programs and laboratories between every two and five years. The external review teams' recommendations enter into DOE's laboratory funding decisions.

When DOE headquarters are interested in new program ideas

originating within the National Laboratories, the ideas are submitted to DOE through formal proposals. These proposals are also mailed to outside scientists for peer review. DOE staff analyze these reviews and decide whether or not to fund a given proposal. In addition, the Office of Health and Environmental Research has recently begun to use external review panels to assess project proposals and ongoing research programs.

Procedures for internal review and contractor review of the National Laboratories' programs vary from laboratory to laboratory. These reviews focus on retrospective evaluation. For instance, at Brookhaven National Laboratory, small in-house expert panels conduct internal review. The panels use the results primarily to evaluate staff and guide promotion and tenure. The laboratory's board of trustees make decisions on tenure, using procedures similar to those in academia. It should be noted, however, that this laboratory is the only one within the DOE that grants tenure.

External committees conduct the internal reviews at Los Alamos National Laboratory. They report their results to the laboratory director. These external committees examine programs within the laboratory's divisions for scientific content, merit, and productivity. Senior laboratory management uses these reviews to decide program suitability, direction, and staffing.

Visiting committees conduct contractor review at Brookhaven. These committees assess scientific programs within that laboratory's departments. Committees give reports to the board of trustees, which discusses the report recommendations with the department. Los Alamos uses contractor review differently — to assess the laboratory's mission in a broad area, such as biology, over its many divisions. Because many different contractors sponsor DOE laboratories, the protocols for contractor review vary widely.

# E
# In-House Review in Private Industry

Review procedures in pharmaceutical and agrichemical company laboratories generally involve internal dialogue and reports between scientists and managers at several levels, as well as external boards of scientific advisors and individual consultants. Written research proposals by company scientists are often the outcome of previous extended discussions with management. Consequently, the company is likely to put these proposals into action. Companies evaluate individual scientists' accomplishments and contributions to the firm; such reviews determine salary increases, promotions, or transfer. Small entrepreneurial companies rely more heavily on their outside scientific advisory boards to guide research directions and evaluate progress. Larger, established companies rely less heavily on external advisory boards. Rather, internal company scientists and managers regularly review their laboratory operations and assess their research programs.

At one representative large agrichemical and health care firm, each scientist submits an annual report summarizing his or her accomplishments, publications, and patents. These reports are circulated within the firm to inform scientists and managers of technical advances. The management evaluates the firm's research programs twice a year. For these reviews the scientists write detailed summaries of their current work and plans and

give oral presentations to their immediate supervisors. The management selects the most significant projects for presentation to higher management and other departments within the firm. These processes help to evaluate and plan research and to disseminate technical advances within a large company.

The management of a representative major pharmaceutical house uses a similar combination of written reports and oral presentations for review of projects within its research laboratories. Those projects deemed meritorious receive wider review within the company. This firm has review systems for new project proposals and ongoing projects. Company scientists, managers, and outside experts from universities and government laboratories critique proposals. The management uses these reviews in deciding which new projects to pursue. The management and departments not directly involved in the project review ongoing projects at least once a year. As projects move into the development phase, managers and research scientists review their progress more frequently. The firm's board of advisors, which is composed of outside scientists with international reputations in their disciplines, also reviews projects yearly. All reviews of ongoing projects are passed through management to the project scientists, who must incorporate the reviewers' recommendations or explain why the recommendations are not appropriate to their research.

## Recent Publications of the Board on Agriculture

### Policy and Resources

Agricultural Biotechnology: Strat s for National Competitiveness (1987), 224 pp., ISBN 0-309-03745-X.
Regulating Pesticides in Food: The Delaney Paradox (1987), 288 pp., ISBN 0-309-03746-8.
Pesticide Resistance: Strategies and Tactics for Management (1986), 480 pp., ISBN 0-309-03627-5.
Pesticides and Groundwater Quality: Issues and Problems in Four States (1986), 136 pp., ISBN 0-309-03676-3.
Soil Conservation: Assessing the National Resources Inventory, Volume 1 (1986), 134 pp., ISBN 0-309-03649-9.
Soil Conservation: Assessing the National Resources Inventory, Volume 2 (1986), 314 pp., ISBN 0-309-03675-5.
New Directions for Biosciences Research in Agriculture: High-Reward Opportunities (1985), 122 pp., ISBN 0-309-03542-2.
Genetic Engineering of Plants: Agricultural Research Opportunities and Policy Concerns (1984), 96 pp., ISBN 0-309-03434-5.
Impacts of Emerging Agricultural Trends on Fish and Wildlife Habitat (1982), 303 pp., ISBN 0-309-03283-0.

### Nutrient Requirements of Domestic Animals Series and Related Titles

Vitamin Tolerance of Animals (1987), 105 pp., ISBN 0-309-03728-X.
Predicting Feed Intake of Food-Producing Animals (1986), 95 pp., ISBN 0-309-03695-X.
Nutrient Requirements of Cats, Revised Edition (1986), 87 pp., ISBN 0-309-03682-8.
Nutrient Requirements of Dogs, Revised Edition (1985), 79 pp., ISBN 0-309-03496-5.
Nutrient Requirements of Beef Cattle, Sixth Revised Edition (1984), 90 pp., ISBN 0-309-03447-7.
Nutrient Requirements of Poultry, Eighth Revised Edition (1984), 71 pp., ISBN 0-309-03486-8.
Nutrient Requirements of Warmwater Fishes and Shellfishes, Revised Edition (1983), 102 pp., ISBN 0-309-03428-0.
Selenium in Nutrition, Revised Edition (1983), 174 pp., ISBN 0-309-03375-6.
Underutilised Resources as Animal Feedstuffs (1983), 253 pp., ISBN 0-309-03382-9.
Nutrient Requirements of Mink and Foxes (1982), 72 pp., ISBN 0-309-03325-X.
Effect of Environment on Nutrient Requirements of Domestic Animals (1981), 168 pp., ISBN 0-309-03181-8.
Feeding Value of Ethanol Production By-products (1981), 79 pp., ISBN 0-309-03136-2.
Nutrient Requirements of Coldwater Fishes (1981), 72 pp., ISBN 0-309-03187-7.
Nutrient Requirements of Goats: Angora, Dairy, and Meat Goats in Temperate and Tropical Countries (1981), 84 pp., ISBN 0-309-03185-0.
Nutritional Energetics of Domestic Animals (1981), 54 pp., ISBN 0-309-03127-3.
Mineral Tolerance of Domestic Animals (1980), 577 pp., ISBN 0-309-03022-6.

Further information, additional titles (prior to 1980), and prices are available from the National Academy Press, 2101 Constitution Avenue, NW, Washington, DC 20418.

National Academy Press

The National Academy Press was created by the National Academy of Sciences to publish the reports issued by the Academy and by the National Academy of Engineering, the Institute of Medicine, and the National Research Council, all operating under the charter granted to the National Academy of Sciences by the Congress of the United States.