National Institutes of Health
Intramural Research Program

Report of the External Advisory Committee of the Director's Advisory Committee

AND

Implementation Plan and Progress Report

U.S. DEPARTMENT OF
HEALTH AND HUMAN
SERVICES
Public Health Service
National Institutes of Health

November 17, 1994
Bethesda, Maryland

Report of the External Advisory Committee of the Director's Advisory Committee National Institutes of Health

Harold E. Varmus, M.D.
Director
National Institutes of Health
Bethesda, Maryland 20892

Dear Dr. Varmus: April 11, 1994

On behalf of the External Advisory Committee of the Director's Advisory Committee, we are pleased to transmit our report on "The Intramural Research Program," pursuant to the request of the U.S. Congress, House of Representatives.

Specifically, the Fiscal Year 1994 House Appropriations Committee Report directed the Director of NIH "to review carefully the role, size, and cost of the Intramural Program, its relationship to the extramural research program," and indicated that NIH must put together a process "for allocating resources to and among its intramural programs based on a thoughtful analysis of these issues."

In response to the mandate of the House Appropriations Committee, the External Advisory Committee met five times over a five-month period between October 1993 and February 1993 and requested and received detailed data on budgets, planning, quality review, personnel and administrative practices, training, industry collaboration, and the status of the Clinical Center from each of the institutes, centers, and divisions of NIH, heard testimony from a variety of intramural personnel, including scientists, institute directors, scientific directors, the Acting Deputy Director for Intramural Research, Clinical Center staff, and administrative staff, solicited comments in writing from the entire professional staff of the intramural research program, and made site visits to the Clinical Center. This report, which contains the Committee's findings and recommendations is submitted in anticipation of congressional appropriations hearings on the NIH budget.

The Committee assessed the many facets of how the intramural research program invests in and maintains its intellectual capital through the review process for senior scientists and scientific directors, the review process for tenure, and the role of postdoctoral fellows in the intramural program. To better understand the quality of the environment in which IRP scientists work the Committee reviewed organizational issues affecting recruitment and retention of scientists and the feasibility of NIH-private sector collaborations as a means for intellectual stimulation and to foster technology transfer.

The continued prospering of the biomedical research establishment rests, as always, on the quality and effectiveness of NIH in carrying out its mission. We hope that our report will be of value to you, the Administration, and Congress, in planning and setting priorities for the future of NIH.

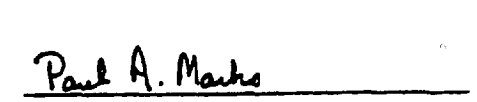
The Committee is grateful for the opportunity to develop this report and wishes to acknowledge the outstanding assistance and cooperation of the Co-Chairs of the Executive Working Group of the Intramural Research Program Fact Finding Committees, Drs. Michael Gottesman and Jay Moskowitz, and the members of the committees.

Respectfully,

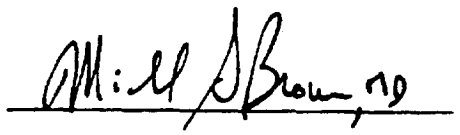
Gail H. Cassell, Ph.D.

Paul A. Marks, M.D.

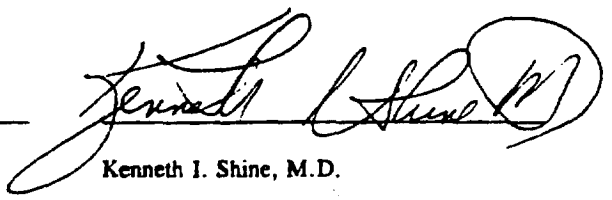
Gail H. Cassell, Ph.D., Co-Chair



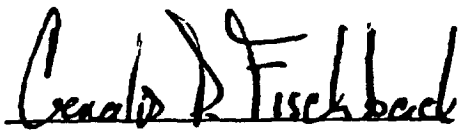
Paul A. Marks, M.D., Co-Chair



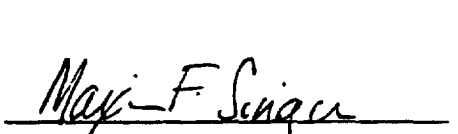
Michael S. Brown, M.D.



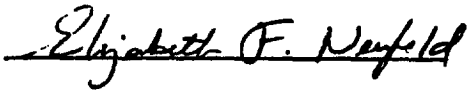
Kenneth I. Shine, M.D.



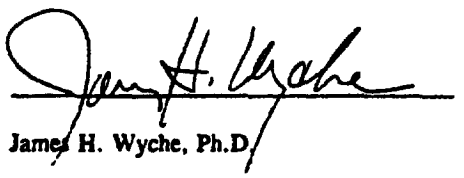
Gerald D. Fischbach, M.D.



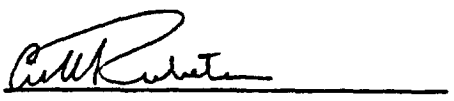
Maxine F. Singer, Ph.D.



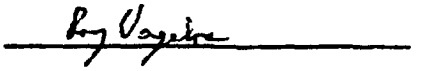
Elizabeth F. Neufeld, Ph.D.



James H. Wyche, Ph.D.



Arthur H. Rubenstein, M.D.



P. Roy Vagelos, M.D.

THE EXTERNAL ADVISORY COMMITTEE OF THE DIRECTOR'S ADVISORY COMMITTEE, NATIONAL INSTITUTES OF HEALTH

Gail H. Cassell, Ph.D.
Co-Chair
Professor and Chair
Department of Microbiology
University of Alabama at Birmingham
Birmingham, Alabama

Michael S. Brown, M.D.
Professor
Department of Molecular Genetics
University of Texas
Southwestern Medical Center
Dallas, Texas

Gerald D. Fischbach, M.D.
Professor and Chair
Department of Neurobiology
Harvard Medical School
Boston, Massachusetts

Elizabeth F. Neufeld, Ph.D.
Professor and Chair
Department of Biological Chemistry
UCLA School of Medicine
Los Angeles, California

Arthur H. Rubenstein, M.D.
Professor and Chairman
Department of Medicine
University of Chicago
Pritzker School of Medicine
Chicago, Illinois

Kenneth I. Shine, M.D.
President
Institute of Medicine
National Academy of Sciences
Washington, D.C.

Paul A. Marks, M.D.
Co-Chair
President and Chief Executive Officer
Memorial Sloan-Kettering Cancer Center
New York, New York

Maxine F. Singer, Ph.D.,
Ex Officio Member
President
Carnegie Institution of Washington
Washington, D.C.

P. Roy Vagelos, M.D.
Chairman of the Board and Chief
Executive Officer
Merck & Co., Inc.
Whitehouse Station, New Jersey

James H. Wyche, Ph.D.
Office of Associate Provost
Brown University
Providence, Rhode Island

Coordinator, External Advisors

Joyce Stichman
Vice President for Academic Administration
Memorial Sloan-Kettering Cancer Center
New York, New York

Science Writer

Kathi E. Hanna, Ph.D.
Washington, D.C.

INTRAMURAL RESEARCH PROGRAM FACT FINDING EXECUTIVE WORKING GROUP

Michael Gottesman, M.D.
Co-chair
Deputy Director
for Intramural Research

Samuel Broder, M.D.
NCI

Anthony Fauci, M.D.
NIAID

Gary Felsenfeld, Ph.D.
NIDDK

John I. Gallin, M.D.
NIAID

Lynn Gerber, M.D.
Clinical Center

Phillip Gorden, M.D.
NIDDK

Enoch Gordis, M.D.
NIAAA

Mark Hallett, M.D.
NINDS

Richard Hodes, M.D.
NIA

Richard Klausner, Ph.D.
NICHD

Claude B. Klee, Ph.D.
NCI

Carl Kupfer, M.D.
NEI

Jay Moskowitz, Ph.D., Co-chair
NIDCD

Edward Korn, Ph.D.
NHLBI

Alan Leshner, M.D.
NIMH

Arthur Levine, Ph.D.
NICHD

Harold Loe, D.D.S.
NIDR

Richard McManus
NEI

Kenneth Olden, Ph.D.
NIEHS

Judith L. Rapoport, M.D.
NIMH

Griffin Rodgers, M.D.
NIDDK

James B. Snow, M.D.
NIDCD

Judith Vaitukaitis, Ph.D.
NCRR

Ex-officio Members

Wendy Baldwin, Ph.D.
Deputy Director for Extramural Research, OD

John Mahoney
Deputy Director for Management, OD

CONGRESSIONAL MANDATE TO THE EXTERNAL ADVISORY COMMITTEE

U.S. Congress, House of Representatives, Departments of Labor, Health and Human Services, and Education, and Related Agencies Appropriation Bill, 1994.

As a central part of the fiscal year 1995 budget planning cycle, the Committee expects the new Director of NIH to review carefully the role, size and cost of the intramural program. This research is currently allocated about 11 percent of the NIH budget. The Committee is concerned that the composition of this research is not based on a well thought out division of labor between the extramural and intramural programs, but rather on a case by case review of research proposals submitted by NIH scientists independent of necessary discussion of whether this research could be adequately addressed through other external mechanisms. In addition to these issues, the Director's review must take into account the limits on space and facilities available on the campus. These facilities are already outdated and need to be replaced at very substantial costs. It is not practical to assume that alternative facilities, such as a new campus, can be built in the foreseeable future. NIH must put together a system for allocating resources to and among its intramural programs based on a thoughtful analysis of these issues.

EXECUTIVE SUMMARY

The intramural research program (IRP) of the National Institutes of Health (NIH) has been among the most distinguished biomedical research establishments in the world. The research achievements and the record of "graduates" of the NIH intramural pro-gram are matched by few biomedical research institu-tions. The NIH Clinical Center, a 450-bed hospital, is one of the world's largest hospitals devoted solely to clini-cal research. It has been a unique and invaluable resource for the direct clinical application of new knowl-edge derived from basic research. Despite this distin-guished past, changes in the national biomedical research environment have led Congress and others to question the quality, appropriateness, size, and cost of the NIH intramural program.

The IRP is one of two components of NIH. The other is the extramural research program (ERP), which supports research at universities and other research institutions throughout the country. The IRP accounts for about 11 percent of the total NIH budget.

The External Advisory Committee has concluded that, unless addressed, problems identified in this report-and several previous reports-may destine the NIH IRP to a mediocre future. A number of factors are placing increasing pressure on the NIH budget, both extramural and intramural. On the one hand are the rapidly expanding opportunities to significantly increase basic biomedical knowledge, accompanied by enhanced capa-bilities for translating such knowledge into clinical appli-cation. On the other hand are rising costs of biomedical research and diminishing opportunities for expansion of the federal budget for biomedical research. These forces are leading to a new reality in the extramural research community. Research judged to be "good," "very good," or even "excellent" is no longer funded. Funding of new grants is at an all-time low of about 15 percent of submit-ted proposals.

The NIH IRP also is facing its own difficulties. Over the past decade, the IRP has experienced problems with recruitment and retention of senior scientists, expansion of a postdoctoral training program of uncertain and uneven quality, cumbersome administrative require-ments, inadequately funded congressional and adminis-trative mandates, and a deteriorating facility infrastruc-ture, in particular the Clinical Center.

Concerns about the health of the NIH IRP contributed, in part, to the establishment of the External Advisory Committee. Specifically, the Fiscal Year (FY) 1994 House Appropriations Committee Report directed the new Director of NIH "to review carefully the role, size, and cost of the intramural program [IRP], and its relationship to the extramural research program," and indicated that the NIH must put together a process "for allocating resources to and among its intramural programs based on a thoughtful analysis of these issues."

Recent congressional concern has focused on three issues with respect to the IRP: 1) whether the level of quality across the IRP continues to place it among the best insti-tutions; 2) whether the allocation of resources to the IRP relative to the ERP can be justified based on rigorous considerations of quality and the importance of the research questions addressed in the IRP; and 3) given the high cost of the needed renewal of the physical facilities of NIH, particularly the Clinical Center, what new and renewed facilities are required to assure high quality research and productivity in the future.

The IRP has a fragmented federated structure with inade-quate processes for oversight by the Office of the Director, NIH. Each institute, center, and division has a different legislative history and mandate from Congress, and each intramural program differs with respect to goals, scope, absolute size, and allocation of funding between extramural and intramural research. This com-plex structure for the administration and conduct of research has both strengths and weaknesses. While it has contributed to a research establishment of great diversity and vitality, it has led to an administrative structure that in the present environment of constrained resources fre-quently hinders effective management of the IRP. This Balkanization of the IRP has contributed to unevenness in quality, quality control, and productivity.

At least three previous advisory committees have made recommendations for improving the IRP, some of which have been implemented but many of which have been ignored. This may be attributed in part to systemic prob-lems that transcend NIH and require major administra-tive or legislative remedies and in part to resistance to change within a large institution.

The IRP possesses several unique characteristics that set it apart from the extramural research program. These include relatively long-term and stable funding of research programs, the availability of the Clinical Center's patient investigational facilities, few or no distractions from research for scientists, and a primarily retrospective rather than prospective review process for determining scientific quality and the funding of research. It must be emphasized that a strong ERP requires a strong IRP and quality—not necessarily uniqueness, should be of the highest priority in determining support for the intramural research program. Those with the responsibility to make decisions must use a rigorous approach to evaluating quality in terms of personnel, training, management, and priority of the research program.

Periodic, objective, unbiased peer review is crucial to the long-term excellence of all scientific institutions, including the NIH IRP. Science progresses, and scientists must respond. The review process can be positive when it calls attention to deficiencies in time for them to be corrected. When improvement is not adequate, a review provides reliable justification for shifting resources from unproductive to more productive scientists. Every effort must be made to put in place personnel systems which facilitate recruitment of outstanding people as well as providing for termination of individuals whose research programs are of inadequate quality or productivity.

The challenge of "reinventing" the IRP requires that NIH rethink some of its practices regarding: 1) NIH-wide appointment and promotion of scientists; 2) recruitment and retention of outstanding scientists; 3) invigorating postdoctoral training programs that transcend institute lines; 4) use of patient and research facilities in the Clinical Center; 5) instituting efficient management and review practices that are more responsive to the needs of the research enterprise; and 6) exploring opportunities for increased collaboration with the extramural community, including industrial and academic laboratories.

The recommendations contained in this report aim to create more uniform and consistent processes for setting priorities and ensuring quality across the NIH IRP. While each institute should retain a level of autonomy in its research programs, more centralized control of the process for ensuring quality is desperately needed.

To enhance quality control, the External Advisory Committee makes a number of recommendations related to review of quality and productivity of scientists, scientific directors, and training programs. It is unlikely that the NIH intramural budget will increase significantly beyond the cost of inflation in the foreseeable future. The need to renovate the Clinical Center is also likely to drain funds from the operating budget of the intramural research program. One way to make room for new investigators will be to reclaim resources from those investigators whose research is no longer productive. This report outlines mechanisms to achieve the goal of re-directing intramural research resources to the most productive programs, thereby improving accountability and freeing resources for new recruitment and new initiatives, and for renewing the Clinical Center.

Major Recommendations

The External Advisory Committee makes the following major recommendations. Additional recommendations and justification and methods for implementation of recommendations are presented in the body of the report.

1. To improve the processes by which senior scientists and scientific directors are reviewed, the External Advisory Committee recommends that a standing Advisory Committee to the Deputy Director for Intramural Research be formed composed mainly of the chairs of the external boards of scientific counselors of each institute, center, and division. This committee should be charged to provide ongoing review of the *processes* of quality control across NIH. The Committee should be chaired by the Deputy Director for Intramural Research (DDIR).

2. Further, to improve quality review, the Committee recommends that the selection and appointment process be altered for the boards of scientific counselors to assure expert, arms-length membership; that the process by which boards of scientific counselors review the programs of intramural scientists be more explicit; and that the criteria used to evaluate scientific directors be made more rigorous.

3. To ensure a strong tenure system that provides the intramural research program with creative and productive scientists, an NIH-wide Tenure Committee, advisory to the Deputy Director for Intramural Research, and composed of 12 to 16 tenured scientists serving staggered terms, should be established to review and recommend for approval (or rejection) all potential appointments to tenure and tenure-track positions. Recommendations for appointments to tenure or tenure track should be made by each institute, center, and division through its existing processes, then forwarded to the Tenure Committee with all appropriate documentary support. Once the NIH Tenure Committee is in place it should no longer be necessary for the NIH Board of Scientific Directors to review or approve tenure decisions.

4. To improve the intramural training program, the independence and career development of trainees should be emphasized. Trainees should be encouraged to seek positions outside NIH following a two- to four-year program so as to continuously provide space and resources for recruitment of new trainees.

5. To provide ethnic diversity in the intramural training programs there should be better linkage with NIH-funded extramural programs, including the NIH Minority Access to Research Careers and Minority Biomedical Research Support undergraduate programs, and with the Short-Term Training Program for physicians. The intramural program also should increase the number of physician scientists from underrepresented minority groups by increasing research experiences for minority medical students.

6. An annual, prospective planning process should be conducted by each institute, center, and division to determine the allocation of resources to the intramural and extramural programs. The process should be outlined in a written document and reviewed, approved, and monitored by the NIH Director and the Advisory Committee to the Director, NIH. Extensive consultation with the extramural research community should be part of this process. The overall NIH scientific mission should be assessed and allocation decisions made on the basis of scientific excellence and opportunity. The total IRP budget for institutes, centers, and divisions (ICDs) should not exceed the current rate of 11.3 percent of the total NIH budget. This percentage should be reviewed and appropriately adjusted through the prospective planning process, following full implementation of the recommendations which emerge from the quality review of the intramural program as outlined in recommendation number 1. It is anticipated that implementation of this process of quality assurance may require 3 to 4 years.

7. The procedures for procurement and staff travel should be streamlined and improved, as should the procedures for appointment of technical as well as scientific staff as part of the process of "reinventing government." NIH could serve as a model for developing and testing novel procedures to make the procurement process efficient and responsive to research needs, while simultaneously ensuring the integrity of federal expenditures.

8. To ensure that the NIH intramural program is fulfilling its mandate to facilitate technology transfer, NIH should broadly communicate in a clear and precise manner the scope, purpose, definition, and processes of implementing and monitoring Cooperative Research and Development Agreements (CRADAs).

9. There is a need for renewal of the Clinical Center. There should be a phased program starting with a 250-bed Clinical Center Hospital and followed by a modular approach to construction and renovation of research laboratories. Funds recovered from phasing out weaker intramural research programs should be used to the extent possible to fund renewal of the Clinical Center. However, recognizing the likelihood that these funds will not be adequate to meet the costs of renewal of the Clinical Center, the Committee recommends that additional funds be allocated by Congress for this purpose. Funds must not be diverted from the extramural program to the intramural program for renewal of the Clinical Center.

10. If, on renewal of the Clinical Center, inpatient nursing units and laboratory research space become available in excess of the needs of the ongoing programs of the Clinical Center, then establishing priority for the use of such space should be the discretion of the Director of NIH, with the understanding that priority should be given to programs currently housed off the Bethesda campus (both clinical facilities and research laboratories). Such consolidation of NIH intramural programs should facilitate quality control and could reduce costs.

11. Recognizing that it is not within the authority of the Director of NIH to change the current classification of the intramural research program as an administrative expense, the Committee strongly believes that it *should not* be classified in this manner. Such a classification leads to budgetary procedures which are not rationally related to the scientific process and which do not support the goal of achieving the highest quality and productivity of the intramural research program.

INTRODUCTION

The Mandate to the External Advisory Committee

Concern expressed by Congress and others regarding the quality, appropriateness, size, and cost of the National Institutes of Health (NIH) intramural research program (IRP) has existed for some time. The mandate which led to the establishment of this External Advisory Committee reflects increasing concern exacerbated by mounting financial constraints on the Nation's biomedical research enterprise. Specifically, the Fiscal Year (FY) 1994 House Appropriations Committee Report directed the new Director of NIH "to review carefully the role, size, and cost of the intramural program," and its relationship to the extramural research program," and indicated that NIH must put together a process "for allocating resources to and among its intramural programs based on a thoughtful analysis of these issues."

While there has been a 2-year history of review of the mission and management of NIH, recent congressional scrutiny has focused specifically on three issues concerning the IRP: 1) whether the level of quality across the IRP continues to place it among the best institutions; 2) whether the allocation of resources to the IRP relative to the extramural research program (ERP) can be justified based on rigorous considerations with regard to quality and importance of research questions addressed in the IRP; and 3) given the high cost of the needed renewal of the physical facilities of NIH, particularly the Clinical Center, what new and renewed facilities are required to assure high quality research and productivity in the future.

The Process of the External Advisory Committee

In response to the mandate of the House Appropriations Committee, a subcommittee of the NIH Director's Advisory Committee (hereafter referred to as the External Advisory Committee or the Committee) was established to review the IRP. A separate internal NIH fact-finding committee was formed in July 1993 to conduct an internal evaluation and assisted the External Advisory Committee in this evaluation by providing data and responding to requests for information. The External Advisory Committee met five times over a five-month period between October 1993 and February 1993; it requested and received detailed data on budgets, planning, quality review, personnel and administrative practices, training, industry collaboration, and the status of the Clinical Center from each of the institutes, centers, and divisions (ICDs) of NIH; heard testimony from a variety of IRP personnel, including scientists, institute directors, scientific directors, the Acting Deputy Director for Intramural Research, Clinical Center staff, and administrative staff; solicited comments in writing from the entire professional staff of the IRP; and made site visits to the Clinical Center. This report is being submitted in anticipation of congressional appropriations hearings on the NIH budget.

The Committee assessed the many facets of how the IRP invests in and maintains its intellectual capital. Specifically, the Committee looked at the review process for senior scientists and scientific directors, the review process for tenure, and the role of postdoctoral fellows in the IRP. To better understand the quality of the environment in which IRP scientists work, the Committee reviewed various means to enhance the attractiveness of the IRP for senior scientists, organizational disincentives to conduct the highest quality research and training, and the feasibility of NIH-private sector collaborations as a means for intellectual stimulation and to foster technology transfer.

The decisionmaking process used to allocate funds between the extramural and intramural programs was reviewed in some detail. Similarly, the need for renewal of the Clinical Center was evaluated carefully. Both these major issues are integrally related to the issues of quality of the IRP personnel and programs.

There is no doubt that the IRP, like all research institutions, includes a great diversity of scientific competence. Like any program of research the size of the IRP, it has its strengths and weaknesses. Although this is not the first review of the IRP, the Committee views the timing of this review as a remarkable opportunity for NIH to reevaluate its mission and goals. Current efforts to "reinvent government" and "invest" in health-related research provide both a challenge and an opportunity for NIH to pursue a deliberative process that will focus on improving the quality and productivity of its research establishment. The presence of a new Director of outstanding scientific

achievement who commands the respect of the national and international biomedical community strengthens this opportunity.

Evolution of NIH and the Intramural Research Program

NIH originated as a one-room "Laboratory of Hygiene" more than a century ago and continued as a limited, free-standing "intramural" research program until World War II. NIH remained primarily an intramural effort until after World War II, although it collaborated with academic institutions during wartime to solve war-related health problems such as the need for large-scale production of penicillin and the need for new drugs for malaria. In 1944, legislation was enacted authorizing the Public Health Service (PHS) to make grants to universities, laboratories, and hospitals for the conduct of research. The goals of the grants program were to enable medical research to expand in size and scope and to focus more research attention on chronic diseases.

After the war, Vannevar Bush, director of the Office of Scientific Research and Development, outlined a program for postwar scientific research which affirmed the contributions of "remote and unexpected fields of medicine and the underlying sciences" in the progress against disease, and the benefits of cooperative endeavors with industry and academia. Noting that traditional sources of support for medical research—i.e., endowment income, foundation grants, and private donations—were diminishing while research costs were rising, Bush advocated the provision of government grants to medical schools and universities for the conduct of basic research and training.

Congressional interest in NIH also increased in the 1940s and was expressed primarily through the establishment of research institutes on particular diseases. The disease orientation and categorical structure of NIH had its genesis in the establishment of the National Cancer Institute (NCI) in 1944. In 1948, Congress passed the National Heart Act which created the National Heart Institute and soon after established institutes for research on mental health, oral diseases, neurological problems, and blindness. Today there are 24 institutes, centers, and divisions (ICDs) within NIH.

The early success of the extramural component of NCI inspired confidence in the concept of an extramural/intramural mix, which became the model for the creation of all subsequent ICDs. Until 1947 the intramural program received the larger share of NIH appropriations. In that year funds were evenly divided with each sector receiving approximately $4 million. For at least the past decade, the intramural allocation has remained stable at approximately 11.3 percent of the total NIH appropriation.

As a result of sustained support from NIH, the U.S. biomedical research enterprise has produced a wealth of biological knowledge and has greatly increased our capacity to prevent, ameliorate, and cure many diseases. The IRP has been an integral part of that success. The NIH IRP includes 1,100 tenured scientists, 250 staff scientists, 2,146 non-tenured scientists, 2,410 postdoctoral trainees, and 194 other trainees, most of whom work on the 317-acre campus in Bethesda, Maryland. In addition, NIH provides over 32 percent of the money allotted for the support of health research and development in the United States, and provides over 82 percent of the total federal funds expended for support of medical research in universities, medical schools, and research institutions.

In a 1991 analysis of scientific productivity, as measured by numbers of scientific publications and citations of that work, NIH ranked near the top not only in quantity, as measured by number of papers, but also in quality, as measured by the number of citations per paper, particularly in the categories of acquired immunodeficiency syndrome (AIDS) research, gene therapy, and cardiovascular and respiratory medicine. NIH intramural scientists' citation histories rank in the top one hundredth of one percent.

The scientific accomplishments of the IRP are numerous and cover a broad spectrum of scientific inquiry. Intramural scientists have made many important contributions to the advancement of biomedical science, of which space permits only a few to be cited here: 1) solving the genetic code;[1] 2) elucidating the mechanism by which adrenalin and other hormones and drugs are metabolized;[2] 3) unraveling the mechanism for protein folding;[3] 4) discovering the slow viruses and their causative role in disease;[4] 5) developing the blood test for AIDS; 6) elucidating the role of viruses in tumor development; and 7) defining the crystallographic structure of immunoglobulin molecules. These fundamental advances have exerted a widespread impact in many areas of medicine and biology. In addition, the NIH IRP has made significant contributions in more targeted areas of clinical research, such as gene therapy, AIDS research, immunology, and cancer treatments.

The quality of research in the intramural program also is reflected in the numerous honors and awards bestowed on its past and present scientists, including 13 Nobel Laureates who have worked in the IRP, 34 Lasker Foundation awardees, and 109 members of the National Academy of Sciences who have worked in the IRP, 44 of whom are still conducting research at NIH. These data

indicate that NIH scientists are among the nation's most highly regarded researchers.

Although the intramural and extramural programs of NIH have prospered in the past, three recent concerns dictate the need for change: 1) the failure of the total NIH budget to keep pace with the growing demands of the extramural research community, a circumstance which has led to especially severe constraints in the funding of young investigators; 2) uncertainty about the quality of some parts of the IRP; and 3) the physical deterioration of the NIH Clinical Center, which requires replacement or extensive renovation. The resolution of one of these issues cannot be achieved at the expense of the others without damaging the quality and integrity of NIH.

Past Reviews of the NIH Intramural Research Program

Both the extramural and intramural programs of NIH have been reviewed on several occasions during the past 20 years in response to mandates from the Administration and Congress. The size of the NIH budget (now approaching $11 billion), the public's expectations about the return on that investment, perceptions with respect to the quality and productivity of the biomedical enterprise, questions as to the proper mission and focus of the IRP, disenchantment with the federal bureaucracy, tensions between the executive and legislative branches, and increasing fiscal constraints have all served as reasons for requesting these periodic reviews of NIH. For example, a 1976 review of NIH by the President's Biomedical Research Panel,[5] a 1988 report of the Institute of Medicine (IOM) regarding the NIH intramural program,[6] and more recently the 1992 report of the Task Force on the Intramural Research Program of the National Institutes of Health[7] all addressed many of the same issues addressed by this Committee. In addition, a special Advisory Committee to the Secretary of Health and Human Services was established in 1989 to develop recommendations on strengthening the role of the NIH Director. Although no report was ever issued that Committee made many recommendations for strengthening the IRP that are relevant to the work of this Committee.

The lessons of the past are instructive for the future. While many of the recommendations made by the President's Panel, the IOM, and the 1992 Task Force have been acted on, many of the problems described and recommendations made could easily be restated today. This may be attributed in part to systemic problems that transcend NIH and require major executive or legislative remedies and in part to resistance to change among some IRP staff members. Interestingly, there has been some continuity to the deliberations of these various bodies since several members of the currently constituted External Advisory Committee have served on one or more of these review groups. Thus, members of this Committee began the current deliberations with knowledge of the work of previous groups.

The President's Biomedical Research Panel

The President's Biomedical Research Panel was established in January 1975 under Public Law 93-352, to review and assess the conduct, support, policies, and management of biomedical and behavioral research as conducted and supported through programs of NIH and the Alcohol, Drug Abuse, and Mental Health Administration (ADAMHA). Over a period of 15 months, the seven-member[8] panel conducted an extensive study that involved assessments of the state of the science, the impact of federally-funded research on institutions of higher education, the organization and management of NIH and ADAMHA, the dissemination and publication of research findings, and the development of policies both for federal support of biomedical and behavioral research and the relationships of NIH and ADAMHA to industrial sponsorship of biomedical research.

Among the many recommendations made by the President's Biomedical Research Panel in 1976, the following are particularly relevant to the IRP and to the deliberations of this Committee in 1994:

- Congress should consider thoroughly the best scientific and professional views before mandating new programs, and provide funds and personnel for such programs. Otherwise, these initiatives will seriously reduce the efficiency of the overall research enterprise.

- To meet the needs of more outpatient and ambulatory work of the Clinical Center, the Panel endorsed the construction of a new ambulatory care facility, as well as adequate resources for maintaining and modernizing the Clinical Center.[9]

- Appointments to membership on boards of scientific counselors (BSCs) must be based primarily on scientific competence rather than on political considerations. Each BSC should have the necessary scientific representation essential to its function and should report annually on the results of its reviews to the institute director and to the Director of NIH.

- NIH should have the authority to support training grants, fellowships, and research career development awards as part of its general authority.

- Congress should consider establishing a special personnel system for NIH [and ADAMHA] that would improve the method for periodic evaluation of the activities of all research personnel and scientist administrators. The review would determine who should continue to have career status in the system, who should be reassigned to other duties, or would be retired because they no longer meet the highest standards of quality and productivity in research endeavors.

- The pay rates of the Executive Schedule should be increased substantially because of the adverse effects of the salary ceiling on the recruitment of able scientists and administrators.

- A more flexible method should be available for controlling the size of the federal work force than restrictions on the number of full-time-equivalency personnel.

Institute of Medicine Report

In 1988, responding to concern that the NIH intramural program was experiencing difficulties in attracting and retaining outstanding basic scientists and clinical investigators, the IOM10 issued a report with wide-ranging recommendations regarding:

- Increasing the flexibility in personnel administration, including simplified hiring classification and pay administration, occupation-based pay standards, the ability to exceed federal pay ceilings in justifiable circumstances, portable retirement benefits, and the replacement of employment ceilings with personnel expenditure budgets.

- The formation of a congressionally-chartered foundation to permit private support of endowed chairs for distinguished scientists.

- Streamlining of administrative matters with more authority delegated by the Secretary of Health and Human Services to the Director of NIH.

- The institutionalization of a Director's Discretionary Fund to be used to address emerging issues and special inter-institute research opportunities.
- Improvement in the review of the IRP, including review by a subpanel of the Director's Advisory Committee, and more routine review of the scientific directors and their intramural programs.

- Creation of an NIH Scholars Program in which outstanding young investigators at the assistant professor level would be appointed on a competitive basis to an independent, non-tenured position in the IRP.

Progress has been made in several areas addressed in the recommendations made by the IOM panel. Specifically, the Secretary of Health and Human Services delegated authority to make many key scientific personnel decisions to the NIH Director and has signalled her intent to fully implement the Senior Biomedical Research Service (SBRS) provisions that would allow higher salaries for distinguished senior investigators. In addition, discussions have been initiated to establish a foundation to permit private support of endowed chairs for distinguished scientists.

Recommendations of the Secretary's Advisory Committee on NIH

The Secretary's Advisory Committee on NIH[11] met several times in 1989 to develop a series of recommendations to strengthen the role of the NIH Director. At the time, a prolonged search for a new Director was underway and the perceived unattractiveness of the job was cited by many as one of the reasons for the difficulty in finding a suitable candidate. Among the recommendations made by the Secretary's Committee, the following are relevant to the current Committee deliberations:

- Bolster the NIH Director's ability to recruit and retain senior level staff by adjusting the salaries associated with these positions.

- Delegate to the NIH Director the authority to make appointments to the Senior Scientific Service and the Senior Executive Service and to make related decisions including pay setting, promotion, reassignments, job classifications, and bonuses.

As noted previously, action has been taken in both of these areas since the original recommendations were made by the IOM committee in 1988 and reiterated by the Secretary's Advisory Committee in 1990.

Task Force on the Intramural Research Program of the NIH

The Task Force on the Intramural Research Program of the NIH was appointed by Bernadine Healy, Director of NIH, to prepare a report concerning the scientific vitality, excellence, and eminence of the IRP and to recommend actions aimed at reinforcing its strengths and at insuring a robust future. The Task Force relied on the views of working intramural scientists in their deliberations and developed two sets of recommendations for improving the IRP, one set requiring new legislative authority, and one which would be feasible within the current governing authority of the IRP. The latter includes:

- Organization of permanent faculty organizations trans-NIH which would participate in the decision making of the institutes.

  Issues of recruitment, including the establishment of discipline-based postdoctoral fellowships administered through the faculties, a clearly defined tenure track policy, and funding for recruitment of tenure-track scientists from outside the IRP.

- The development of a uniform site review process and review of science administration in the review process for laboratory and branch chiefs and scientific directors.

- The establishment of an Administrative Policy Board to serve as a central advisory board to evaluate the impact of administrative decisions on the conduct of research.

Challenges Remain

In accord with the recommendations of these panels and committees, NIH has made numerous efforts to change the quality and management of the IRP. It has targeted scientific quality assurance by strengthening accountability and rigor in BSC reviews and instituted BSC review of scientific directors. It has enhanced the quality and uni-formity in promotion and tenure review and has estab-lished guidelines for the conduct of research, including research with animals and human participants.

In career development and training the NIH has increased the number of accredited clinical training pro-grams, established an Office of Education, created a tenure track, and expanded outreach programs. It also has tried to improve inter-institute communication through publications, research festivals, and consideration of instituting faculties along scientific disciplines.

There is still a need to improve the overall strategic planning process of the IRP administrative procedures, the rigor of reviews for quality, and the decision making process for allocation of resources between the IRP and ERP and within the IRP.

To a large extent, the IRP is a victim of its own success. A large fraction of the leadership in the extramural biomedical research community received its training in the NIH intramural program. In addition, the NIH ERP has enabled medical research to expand in size and scope. This expansion, combined with constrained federal funding for biomedical research and reduced research purchasing power, has focused attention on the appropriateness of resource allocation between the IRP and ERP in terms of their relative shares of the entire NIH budget. For example, given the relatively more rapid expansion of the extramural research community over the past two decades, the question has been asked as to why the IRP portion of the NIH budget has remained relatively-'constant during this same period of time.

The IRP possesses several unique characteristics that set it apart from the ERP, such as relatively long-term and stable funding of research programs, the availability of the Clinical Center's patient investigational facilities, relatively few or no distractions for scientists from research, and a primarily retrospective rather than prospective review process for scientific quality. These unique features should be considered when designing research programs and allocating resources among the extramural and intramural programs. It must be emphasized, however, that a strong ERP requires a strong IRP, and quality, not necessarily uniqueness, of a research program should be of the highest priority in determining support If the decision-making process used in allocating funds between the extramural and intramural programs is driven by quality, there will be opportunities to downsize some programs while expanding others.

The process of establishing priorities must accommodate two irrefutable forces: rising costs of biomedical research and the faltering levels of funding for biomedical research. It is a fact that biomedical research costs have for some time now been increasing at a rate above the national rate of inflation; this is likely to continue due to the labor intensity of the research effort and the increase in the complex equipment and supplies required. Ironically, this situation is further aggravated by the explosion of knowledge with respect to biology and medicine which continuously expands the opportunities for laboratory research and for clinical applications in the areas of disease prevention, more effective means of early diagnosis of disease, and more definitive approaches to therapeutic interventions.

The IRP should not be viewed as having the potential to be all things to all aspects of biomedical research. Rather, it should focus on and exploit its particular areas of expertise, which are shaped by the knowledge and skills of its laboratory and clinical scientists, and a unique ability to aggregate multidisciplinary intellectual and physical resources. In all instances, there should be in place a rigorous process of establishing priorities for research that is simultaneously responsive to the realities of rising biomedical research costs and increasing financial pressures on the biomedical research community. Every effort must be made to remove the unnecessary administrative impediments to facilitate the research process and to put in place personnel systems that allow downsizing IRP laboratories judged unworthy of support.

This is a time of unusual opportunity for the NIH intramural program to develop processes and programs that clearly emphasize the quality and importance of the research questions being asked.

A rapidly expanding knowledge base in biology and medicine and the potential for clinical application has presented unprecedented opportunities for advances in disease prevention, diagnosis, and treatment. It becomes particularly important that the IRP streamline many of its practices, particularly those concerning personnel, training, and technology transfer. The rapidly expanding biotechnology industry has relied on, and will continue to rely on thoughtful and flexible approaches to collaboration with NIH in key areas of biomedical research and development. Given the historical opportunities for advancing human health, NIH should make all efforts to minimize, to the extent possible, the cumbersome nature of its administrative practices. In addition, institutional barriers which are disincentives for cross-institute collaborations or trans-NIH use of resources should be identified and, as far as possible, reduced.

The challenge of "reinventing" the IRP will require NIH to rethink some of its practices to ensure quality, particularly in the areas of: 1) the review process for senior scientists and scientific directors; 2) the review process for tenure; 3) postdoctoral training; 4) organizational issues affecting recruitment and retention, e.g., management practices that are more responsive to the needs of the research enterprise; and 5) vigorous and appropriate collaboration with the private sector. NIH also must evaluate and formalize the processes by which allocation decisions are made between the intramural and extramural programs. Finally, as NIH prepares to renew the Clinical Center, the plan for revitalization should be informed by a careful evaluation of the quality and necessity of clinical research programs in the IRP.

This report examines the issues identified above and suggests ways to achieve the goal of re-directing IRP resources to the most productive programs, thereby freeing resources for expanding IRP recruitment activities and for renewing the Clinical Center. The Committee also makes recommendations designed to minimize bureaucracy in order to enhance the productivity of IRP scientists and enable the IRP to attract the most outstanding individuals to its ranks.

Notes

1 Dr. Marshall W. Nirenberg of the National Heart, Lung, and Blood Institute shared the Nobel Prize in Physiology or Medicine in 1968. Dr. Nirenberg was the first NIH Nobelist and also the first federal employee to receive a Nobel Prize.

2 Dr. Julius Axelrod, National Institute of Mental Health, shared the Nobel Prize in Physiology or Medicine in 1970.

3 Dr. Christian B. Anfinsen, formerly with the National Institute of Arthritis, Metabolism, and Digestive Diseases, won the Nobel Prize in Chemistry in 1972.

4 Dr. Carleton Gajdusek won the Nobel Prize in Physiology or Medicine in 1976.

5 *Report of the President's Biomedical Research Panel,* submitted to the President and the Congress of the United States (U.S. Department of Health, Education, and Welfare, Public Health Service, DHEW Publication No. (OS) 76-500), April 30, 1976.

6 Institute of Medicine, *Report of a Study: A Healthy NIH Intramural Program: Structural Change or Administrative Remedies?* (Washington, DC: National Academy Press, 1988).

7 *Report of the Task Force on the Intramural Research Program of the National Institutes of Health,* transmitted April 13, 1992 to Dr. Bernadine Healy, Director, National Institutes of Health, from Richard D. Klausner, Ph.D., Chief, Cell Biology and Metabolism Branch, National Institute of Child Health and Human Development, NIH.

8 Panel members included Franklin D. Murphy, Chair; Ewald W. Busse; Robert H. Ebert; Albert L. Lehninger; Paul A. Marks; Benno C. Schmidt; and David B. Skinner.

9 The new Ambulatory Care Research Facility was built in 1980.

10 Committee members included Harold T. Shapiro, Chair; Michael S. Brown; John T. Dunlop; Gerald D. Fischbach; Marian E. Koshland; Charlotte V. Kuh; Robert I. Levy; Walter E. Massey; Robert G. Petersdorf; Paul Grant Rogers; Benno C. Schmidt; Lloyd H. Smith; Elmer B. Staats; and P. Roy Vagelos.

11 Members included Louis W. Sullivan, Secretary; James O. Mason, Assistant Secretary; Theodore Cooper; Eugene Cota-Robles; James F. Dickson III; Donald S. Fredrickson; James R. Gavin, III; Paul Gray; Paul A. Marks; Edmund D. Pellegrino; Paul G. Rogers; David Satcher; Benno Schmidt; Maxine Singer; Samuel O. Thier; P. Roy Vagelos; and Linda S. Wilson.

REVIEW PROCESS FOR TENURED SCIENTISTS AND SCIENTIFIC DIRECTORS

Periodic peer review is crucial to the long term excellence of all scientific institutions, including the NIH IRP. Science progresses, and scientists must respond. The review process can be positive when it calls attention to deficiencies in time for them to be corrected. When improvement is not adequate, a review provides reliable justification for shifting resources from unproductive to more productive scientists.

Stringent review of the NIH intramural program is needed now, more than ever, because of the institutional "aging" typical of most large organizations and because of budgetary constraints. No scientific institution can long excel without a continued infusion of fresh, independent investigators. It is unlikely that the NIH intramural budget will increase significantly beyond the cost of inflation in the foreseeable future. The cost of renovating the Clinical Center also is likely to drain funds from the operating budget of the IRP. One way to make room for new investigators will be to reclaim resources from those investigators whose research is no longer productive. Such reclamation is essential for the long term health of the NIH.

The current system that guides review of intramural research scientists rests heavily on the discretion of the scientific director, who exerts a high level of control on the membership and the agenda of the board of scientific counselors for each institute. The benefit of this concentration of power is that it allows for flexibility and creativity on the part of the scientific director, but a danger lies in the system's complete reliance on the ability of that director to discern and adequately reward excellent scientists. Experience has taught us that the best way to maintain the productivity of a research program is through objective peer review. It was not evident to the External Advisory Committee that review of scientists within the intramural program is uniformly objective or that there is sufficient distance between the boards of scientific counselors and the scientific directors to ensure objectivity in review.

Currently, peer review of the NIH intramural program is conducted by the BSC of each institute. Each BSC consists of extramural scientists chosen for their expertise in the scientific fields covered by the institute. In the past, BSC members have been selected by the scientific director of the institute and appointed by the NIH Deputy Director for Intramural Research. A 1988 Institute of Medicine committee report on the NIH intramural program[1] and a 1989 report of a Consultant Panel to the Advisory Committee to the Director, NIH, both concluded that the system of making appointments to the BSC was inadequate.

Although outstanding scientists have been appointed to the various BSCs, their roles are not clearly defined. The selection process implies that the consultants are advisory to the scientific director of the institute, rather than to the institute director and the DDIR. In many cases advisors are funded by the institute under review. To better serve the process of review for each institute's IRP a more independent group of reviewers is needed.

The two previous advisory committees indicated above concluded that the BSCs should be more active in reviewing the performance of the scientific director. Just as individual scientists must change continuously in order to keep up with new concepts, the scientific directors must adapt over time. The BSCs must evaluate regularly the performance of the scientific director along with the overall achievements of the entire institute. Objective review is difficult when the BSC is nominated by and reports to the scientific director.

As a result of suggestions made by the two previous committees the review process has been strengthened to a measurable degree. In particular, the scientific director is now required to respond formally to the criticisms of the BSC and to justify actions taken in response to the criticism. Despite these positive steps, further improvement is essential to satisfy the criteria for stringent review.

The External Advisory Committee recognizes and wishes to preserve the special nature of research performed at NIH as contrasted with extramural research. The excellence of the overall NIH program is built upon a variety of approaches to the management of research. Prospective and retrospective evaluation procedures have different strengths and weaknesses, and encourage cre-

1 Institute of Medicine, *Report of a Study: A Healthy NIH Intramural Program: Structural Change or Administrative Remedies?* (Washington, DC: National Academy Press, 1988).

ativity in different ways. The overall NIH system is best served by retaining prospective review in the extramural program and retrospective review in the intramural program.

The recommendations below are designed to preserve the special status of the IRP by:

1) retaining the retrospective review process, which is focused largely on accomplishments over the past 3 to 5 years, rather than adopting a prospective review that would be focused on specific proposed projects;

2) having the review conducted by panels of recognized experts (the BSCs) whose membership is expected to be more mature and distinguished than the membership of many extramural study sections;

3) allowing the intramural scientist to make an oral presentation to the BSC, and to respond to questions and criticisms orally without the necessity of writing a long grant report; and

4) asking the review panels to take into consideration the long-term nature of some of the projects at NIH, thereby lessening the pressure to produce immediate results.

To improve the processes by which senior scientists and scientific directors are reviewed, the External Advisory Committee recommends that a standing advisory committee for intramural research be formed to review quality control, that the selection and appointment process be altered for the boards of scientific counselors to assure expert, arms-length membership, that the process by which BSCs review tenured scientists be more explicit, and that the criteria used to evaluate the scientific director reflect a commitment to an improved process of quality review.

RECOMMENDATIONS

1. Establish an External Advisory Committee to the Intramural Research Program.

The Deputy Director for Intramural Research and the chairpersons of all of the BSCs shall constitute a new committee, herein called the "External Advisory Committee to the Intramural Research Program," to be chaired by the DDIR.

The committee should have its first meeting within three months of the acceptance date of this report. At the meeting the DDIR should explain the new ground rules for the review process, stressing the need for stringent quality control and the necessity to free up resources for new recruitment. The government mandate to reduce the number of personnel at rank GS-14 or above should be thoroughly analyzed in terms of the implications for retention of senior scientists and recruitment of young and established scientists. The committee and the DDIR should draft written guidelines for the BSC members and chairpersons outlining duties and responsibilities. These guidelines should stress the crucial role of the BSCs in determining the future of the NIH intramural research program. Thereafter, the External Advisory Committee to the Intramural Research Program should meet at least annually and more often as needed. At each meeting the chairperson of each BSC should make a brief oral report of the state of the institute, outlining its significant accomplishments, and highlighting any weaknesses that have been found. These meetings should help to maintain uniform standards among the institutes.

2. Revise the processes for selection and appointment of boards of scientific counselors.

New members of each BSC shall be recommended by a vote of the current BSC members. Attempts should be made to include scientists with a broad range of background, and views. Nominations may be made by the members of the BSC, the scientific director of the institute, the DDIR and others. The invitation to join the BSC should come from both the DDIR *and* the chairperson of the BSC, and not from the institute scientific director. The chairperson of each BSC shall be elected from and by the membership of the BSC and shall serve for a set term, extending the total term on the BSC as required. The term of appointment for members should be for four years, and membership is renewable for one term. Each BSC should include women and members of underrepresented minorities in concert with government policy. The rule that excludes scientists who serve on extramural review panels such as NIH study sections and councils should be abolished.

At least one third of each board of scientific counselors should be composed of scientists whose major grant funding comes from sources outside of the institute under review. It would be preferable if the chairperson of the BSC did not receive the majority of his or her research funds from the institute. A significant proportion of participants on any site visit should be permanent members of the BSC, but the use of ad hoc experts is encouraged particularly to ensure that individuals being reviewed for tenure are reviewed by individuals knowledgeable in their field.

Every four years, the members of the BSC should review the overall status of the institute's intramural research program and should vote whether to recommend the institute's scientific director for a new four-year term.

A major criterion for evaluation of the scientific director should be the extent to which he or she has considered or implemented the recommendations of the BSC with regard to resource allocation to individual scientists. This should include review of the quality and career development of trainees and junior scientists in the institute. The review of the scientific director should also include, in part, a review of the interactions and programs involving extramural scientists and inter-institute collaborations within the IRP. A report should then be transmitted to the DDIR who in turn will make a recommendation to the institute director.

3. Make more uniform and explicit the review process for tenured scientists and scientific directors.

The BSC should review each tenure track investigator in the institute every three years, and each tenured investigator every four years, according to a schedule provided in advance to each scientist. The reviews should be conducted on site. Each BSC member should be required to attend at least two site visits annually.

Prior to the review session each scientist shall submit a brief (less than 3 single-spaced pages) written summary of work undertaken since the last review, together with a list of publications and important reprints. In addition there should be a brief outline of future directions. Two BSC members should be assigned as primary and secondary reviewers of each scientist.

At the site visit, the scientist under review should be allowed sufficient time to make an oral presentation (at least 30 minutes) followed by a period of questioning by the site visitors.

The practice of being judged on past achievements without having to specify future projects in detail distinguishes the NIH intramural program from extramural NIH-supported science. The External Advisory Committee feels strongly that this practice should be maintained. Therefore, the review process should concentrate on work already undertaken, rather than on a detailed outline of future work. The BSC should also be cognizant of the role of NIH in supporting long term projects.

The site visit team should be informed of the budget of each investigator, including outside contracts, and of other significant resources (e.g., postdoctoral fellows, space, technicians, meetings, travel).

After each presentation, the site visit team should decide by vote whether to recommend that support be continued for the standard period (three or four years) and whether to recommend an increase or decrease in resources. The BSC may wish to adopt a scoring system by which to rate each scientist's research program, i.e. excellent, very good, good, fair, poor. The site visit team may also give warning that a scientist's progress is in doubt and may request a review sooner than the standard period. If progress is not sufficient after the second review the site visit team may recommend that research support be withdrawn. The primary reviewer should produce a written report, listing the reasons for these recommendations. The report should be approved by the chairperson of the site visit team and the BSC chairperson before it is issued.

The primary criterion for judgement should be scientific excellence. Inadequate science should not be supported simply because it is consistent with the mission of the institute. Laboratory and branch chiefs should be judged in regard to the extent to which they recruit, encourage, and support independent junior scientists, as well as on their own research efforts. BSC members should be knowledgeable about the standards for evaluating scientists in the extramural program. Similar standards should be used to judge the quality of the intramural research program even though the review is retrospective rather than prospective.

The recommendations of the BSC should be made known to the laboratory chief, branch chief, and scientific director of the institute; the institute director; the DDIR; and the council of the institute. The BSC's recommendations are advisory and the decision whether to accept the recommendations should be made by the institute director in consultation with the DDIR. The scientist should be given an opportunity to reply in writing to criticisms, and this response should be considered by the BSC at its next meeting.

Prior to the next BSC meeting, the scientific director should submit a written statement to the chairperson of the BSC, the institute director, and the DDIR. The statement should outline the administrative actions taken in response to the recommendations of the BSC. If the recommendations were not followed, reasons should be given.

REVIEW PROCESS FOR TENURE

The tenure system at NIH has been improved over the past few years in response to internal suggestions as well as to outside review panels. The External Advisory Committee approves the steps taken by NIH to establish a formal tenure track and procedures for insuring the independence of tenure-track scientists.

A strong tenure system provides the clearest assurance that the IRP will always have an input of fresh, independent ideas and will not become simply the extension of the ideas of a few senior scientists. In the NIH system the designation of a scientist as tenure track signifies that the individual is permitted to design and carry out an independent program. Tenure-track individuals are judged on their own merits by the boards of scientific counselors based on originality, independence, and scientific success.

The selection of tenure-track scientists is crucial in assuring the long term success of the NIH. In the past, NIH promoted predominantly from within, selecting scientists who entered NIH as postdoctoral fellows or Junior Associates.[1] Often these individuals have worked for many years under the direct supervision of a laboratory or branch chief. This policy has often created fiefdoms in which many scientists work under the direct control of a laboratory or branch chief. Such large organizations of team scientists whose work is directed from above may be necessary on rare occasions to solve complex scientific problems. In most excellent biomedical research institutions, however, the major advances are produced by creative individuals working on their own with a small group. The External Advisory Committee therefore recommends that NIH would be better served if laboratories and branches contained a larger proportion of independent scientists either tenured or on the tenure track, analogous to the best departments within universities. Several NIH laboratories have operated in this way for many years and their excellent records indicate that this approach is feasible within NIH.

As the number of tenure-track scientists increases, it will be even more imperative that all of the institutes use equal standards and adopt a uniform policy with regard to assigning scientists to the tenure track and promoting them to tenure. The recommendations below are largely designed to achieve this goal.

1 According to data collected by the External Advisory Committee, about 70 percent of the tenured appointments made in the past five years were drawn from the non-tenured scientific staff.

RECOMMENDATIONS

1. Make more inclusive the decisionmaking process for filling a tenure-track position.

The decision to create a new position within the tenure track or replace a departing tenured investigator should be made by the senior investigators of an institute, acting as a group, in consultation with the scientific director and with the Deputy Director for Intramural Research. The decision should be consistent with the long term staffing plan of the institute.

2. Widen the field in the search for tenure-track candidates.

Once a tenure-track position is available, a search committee should be established to identify outstanding scientists, including internal candidates and candidates who have completed postdoctoral training outside of the NIH and in NIH laboratories other than the recruiting laboratory, and to recommend a candidate. The search committee should be established by the scientific director and composed of scientists within the intramural program of the institute. It should also include scientists from other institutes who are experts in the scientific discipline under consideration. A good source of search committee members will be the newly formed faculties that are focused on scientific disciplines rather than on institute affiliation.

3. Maintain the current mechanisms for making formal agreements with tenure-track scientists.

The formal agreements with the tenure-track scientist, including guarantees of independence, should be negotiated according to current policy. The six-year term prior to the tenure decision and the procedures for lengthening that term also should be continued.

4. **Create an NIH-wide Tenure Committee, advisory to the Deputy Director for Intramural Research, and composed of 12 to 16 tenured scientists, to review and recommend for approval (or rejection) all potential appointments to tenure and tenure-track positions.**

Proposals for tenure-track appointments should be forwarded to the Tenure Committee by the scientific director, the laboratory or branch chief, and the search committee that has nominated the tenure-track candidate.

When a candidate is to be proposed for tenure, the laboratory or branch chief should assemble the credentials and prepare a formal nomination for consideration by the scientific director and by the tenure committee of the institute. If endorsement is received, the nomination should be presented to the NIH-wide Tenure Committee.

The NIH Tenure Committee should be chaired by the DDIR and composed of tenured scientists selected by the DDIR from nominations provided by the scientific directors. The membership should exclude individuals with institute-wide responsibilities such as scientific directors and deputy scientific directors.

The DDIR should establish a scheme for assuring equitable representation of the various institutes on the committee. The committee should include experts from all of the scientific disciplines represented by the faculties, and it should include women and members of underrepresented minorities.

Membership on the Tenure Committee should be for a term of three years, renewable for one term. Initial appointments should be for staggered terms of one, two, and three years so that approximately one third of the membership is rotating off the committee each year.

Once the NIH Tenure Committee is in place, it should no longer be necessary for the Board of Scientific Directors to approve tenure decisions.

POSTDOCTORAL TRAINING

Quality of Postdoctoral Fellows

The scientific staff of the NIH IRP consist of tenured scientists, tenure-track scientists and non-tenured scientists. Postdoctoral trainees are defined as non-tenured scientists who are within five years of their doctoral degree. The size of the training program within each institute and research program varies and is determined by considerations of science, budget, space, and congressional mandates. The IRP training program is a considerable investment: Training stipends for Ph.D.s alone represent an annual $120 million dollar expenditure of IRP funds.

The IRP has played an important role in postdoctoral training, particularly of physician scientists, and has been a source of new scientists for many extramural institutions. It is estimated that some 50,000 scientists have trained at NIH. Today the IRP is one of the largest trainers of postdoctoral fellows in the United States, with 2,351 fellows. This number represents about 15 percent of NIH-funded postdoctoral fellows in the entire scientific community. Upon leaving NIH, postdoctoral trainees have made valuable contributions not only in academic institutions, but also in the development and success of the biotechnology industry.

The success of the IRP depends on postdoctoral trainees, who constitute 50 percent of the NIH intramural scientific work force. Trainees help plan experimental strategies, carry out experimental protocols, interpret research results, and publish research findings. They also provide the most important pool from which scientists are recruited to permanent, tenured positions in the IRP. About 70 percent (146/206) of the tenured appointments made in the past five years were drawn from the non-tenured scientific staff of the IRP. Although the recent creation of the tenure track may facilitate recruitment from outside of NIH, it appears that the majority of individuals appointed to the current permanent staff first arrived at NIH as postdoctoral fellows. The quality of the postdoctoral fellows is therefore an important determinant of the quality of the entire IRP.

Salaries for NIH Ph.D. postdoctoral fellows are very competitive. The starting salary for Ph.D. postdoctoral fellows within the IRP is $25,000 to $30,000. In comparison, stipends for individual or institutional trainees under the National Research Service Awards begin at $18,000 and cannot be supplemented with funds from other federal sources, i.e. federal grants. This large salary differential should provide a selective recruiting advantage for attracting outstanding trainees to NIH, particularly Ph.D.s. But it also creates a potential problem.

Guaranteed internal funding for postdoctoral fellows during previous years may have affected the acceptance rate and hence the quality of postdoctoral fellows. This is further compounded because there are now mechanisms in place to allow non-tenured postdoctoral fellows to remain at NIH for up to eight years. The fates of these individuals pose a significant human resource issue for the IRP. When these individuals remain in the IRP too long, their own opportunities for further training and for career advancement diminish, and they might become a financial burden to the IRP, potentially precluding recruitment of new postdoctoral fellows.

Based upon indirect evidence, in 1992 the *Report of the Task Force on the Intramural Research Program of the National Institutes of Health*[1] concluded that the overall quality of postdoctoral fellows in the IRP had declined over previous years. There is reason to believe this conclusion. The number of postdoctoral fellows in the IRP has increased significantly over the past five years, but the postdoctoral applicant pool has probably not increased to the same extent during this same period of time.

An Advisory Committee to the Director of NIH, convened in 1989, found that there were no centralized data systems—with the exception of medical staff fellowships—that allowed it to compare the quality of the 1989 cohort of postdoctoral fellows with those from earlier years, nor was there a means of measuring the extent to which the intramural program was having difficulty recruiting the best candidates. Because the application procedure for the medical staff fellowships (the major source of physician scientists) was centralized, some data about this group were available. It was noted that there had been a precipitous drop in the number of applications submitted between 1986 and 1988. While similar data were not available for Ph.D.s , the perception was that the number of applicants to that program had also declined.

In an effort to reverse this trend, in mid-1990 the NIH Office of Education was established within the Office of Intramural Research and was given centralized responsibilities in the areas of recruitment, education, and training. The primary goal of the Office of Education is to increase the visibility of IRP training programs and to make them more accessible and understandable to prospective fellows. As a result of advertisement of 142 postdoctoral positions in 1992, 2,410 applications were received (the ratio of U.S. to foreign applicants is unknown).[2] Despite these efforts to recruit more broadly, the issue of quality of trainees remains unresolved.

There still does not appear to be a coordinated effort to evaluate the quality of training programs at NIH. There is no data base to readily assess the success of individuals who have completed training in the IRP, in terms of such variables as number of years in training, number and quality of publications directly related to the NIH training experience, type of appointments obtained after leaving NIH, success in obtaining independent grant support, number receiving tenure in academic institutions, and achievement of national and international recognition. Without follow-up data and without more data on the quality of the applicant pool of entering postdoctoral Ph.D. fellows, the External Advisory Committee is hesitant to comment further upon the quality of the current IRP training programs.

The example of one successful IRP laboratory may serve to emphasize the importance of viewing postdoctoral fellowships as temporary employment. This laboratory recently employed several superb fellows, but only one was offered a tenured position because of perceived overlap with ongoing programs. The future independence of the trainee was a major consideration as well as the enrichment of the IRP. The unlikelihood of promotion was made clear to each of the fellows before they accepted positions at the NIH. Funds saved by terminating postdoctoral fellows in a timely manner were used to recruit a tenure-track scientist from the outside. Excellent start-up packages including 450 to 900 square feet of space, funds to purchase all necessary equipment, an independent operating budget, and commitment of funds for technical support and postdoctoral fellows were made available through the recruitment.

Ethnic and Gender Diversity of Postdoctoral Trainees

The current ethnic diversity of the post-doctoral fellows should be improved. In 1992, only 5 percent were underrepresented minorities. The major barrier to recruitment of underrepresented minorities within the IRP and also in the extramural scientific community can be ascribed to the "pipeline" problem. In 1992 there were 4,672 U.S. citizens who received Ph.D.s in the life sciences. Of this total, African Americans received 86, mainland Puerto Ricans received 36, Mexican Americans received 30, and Native Americans received 20.

With regard to non-physician trainees, over the course of the 1980s there has been little change in the number of independent underrepresented minority scientists resulting from recruitment at the pre- and postdoctoral levels, suggesting that the key to increasing the number of minority scientists lies much earlier than the predoctoral years. To the extent possible, the IRP should broaden its focus to encourage greater minority participation at earlier ages. In 1992, underrepresented minorities received 8.3 percent of all M.D. degrees awarded and, therefore, represent a larger pool among M.D.s than Ph.D.s. Of M.D.s awarded in 1992, African Americans received 850, mainland Puerto Ricans received 101, Mexican Americans received 259, and Native Americans received 63.

A recently proposed approach to achieving the goal of increasing the number of underrepresented minorities who are physician scientists—the Physician-Investigator Preparatory Program—appears to be an excellent approach.[3] The basis of this approach is to provide research experiences for minority medical students during medical school and also to reduce the cost of medical school for those wishing to pursue a research career. It would also expand the pool of minority postdoctoral candidates that might be recruited to the IRP.

Improving linkage with the NIH Minority Access to Research Careers and Minority Biomedical Research Support undergraduate programs and with the Short-Term Training Program for physicians could expand, recruit, and hopefully retain far greater numbers of underrepresented minorities in the biomedical research community than is currently observed nationally and in the IRP.

In 1992, 36 percent of postdoctoral trainees in the IRP were female. The number of women receiving Ph.D.s in the life sciences has increased dramatically in the last 20 years from a few percent to 39 percent in 1992, and the number continues to rise.[4] Women trainees within the IRP disproportionately are faced with career advancement problems associated with other workplace issues, such as family leave and flexible scheduling. The IRP could encourage greater participation of women by endowing its programs with the maximum flexibility possible, and by implementing formal policies for family leave and part-time training. Such policies, moreover, are likely to improve the training environment for all trainees. Once in the IRP, effective mentoring programs

should be in place to enhance retainment and career development of minority and women trainees.

Career Advancement

A number of initiatives have been taken by the NIH Office of Education to improve the training experience of NIH postdoctoral fellows, including lectures on career development, grant-writing workshops, a fellows seminar series, and the establishment of an NIH Fellows Committee with representatives from the basic and clinical sciences in each of the ICDs offering training. These efforts are to be commended.

Broad training should be encouraged in addition to rigorous focused work on a single project. This is crucial if the trainee is to have the greatest range of flexibility as an independent scientist to make original contributions to his or her field. Every effort should be made to develop training programs which cross disciplines and promote interfaces between categorical institutes. Increased emphasis on multi-institutional consortia offers the opportunity to strengthen the quality and expand the diversity of research training environments. In this regard, establishment of more scientific interest groups such as those recently formed in structural biology, cell biology, neurobiology, and genetics, should be encouraged. In addition, the training programs of the IRP would be enhanced by more outreach to the extramural community.

Effective mentoring must be established in all laboratories. Concerns raised about the effective use of postdoctoral fellows and the nature of their training experience cannot be generalized. The functioning and experience of a postdoctoral fellow is determined within the individual laboratory by the quality of the research program and the dedication of the mentor. The quality of a scientist's mentoring should be considered in the evaluation process for promotion and tenure as well as program review. While this is already taking place within some institutes, it is not clear that it is a requirement for all laboratory directors.

RECOMMENDATIONS

1. **The External Advisory Committee supports the concept that the best way to ensure the quality of trainees is to maintain the high quality of the training faculty.**

2. **To identify the most outstanding postdoctoral candidates, intramural training programs should draw from a diverse, well qualified applicant pool.**

Particular attention should be given to recruitment of women and underrepresented minority fellows.

To recruit the best physician-scientist trainees, NIH should investigate the possibility of establishing a two-year National Health Service Program, which would permit graduates of medical schools an opportunity to pay back their loans through service as postdoctoral fellows.

A Distinguished Scholars Program should be established to facilitate recruitment of the best postdoctoral fellows.

Selected trainees should be actively recruited. For example, students in the extramural community supported on individual National Research Service Awards, National Science Foundation predoctoral fellowships, or Howard Hughes Medical Institute Predoctoral Awards and Predoctoral Research Fellowships for Physicians have already demonstrated their exceptional potential. They serve as an excellent predefined pool from which to recruit postdoctoral fellows.

3. **To improve the quality of postdoctoral fellows the availability of postdoctoral positions should be advertised widely. Objective criteria by which to judge applicants should be formulated, and should include publication record and research presentations. Oversight committees within institutes or research faculties should approve selections.**

4. **To improve the intramural training program, the independence and career development of trainees should be emphasized.**

Trainees should be encouraged to seek positions outside NIH following a two- to four-year program so as to continuously provide space and resources for recruitment of new trainees. To ensure that the quality of the training experience is not eroded, special programs, seminars, and workshops should be continually developed to meet the needs of postdoctoral fellows. In addition, grants workshops such as those sponsored by the National Institute of General Medical Sciences should be expand-

ed to assist fellows in establishing their future research independence.

5. **To provide ethnic diversity in the intramural training programs there should be better linkage with the NIH Minority Access to Research Careers and Minority Biomedical Research Support under graduate programs, and with the Short-Term Training Program for physicians. The intramural program should also increase the number of underrepresented minority groups among physician scientists by increasing research experiences for minority medical students.**

6. **To ensure that intramural training programs are of the highest quality, there must be ongoing rigorous assessment of all training activities.**

NIH should undertake a thorough, comprehensive evaluation of its intramural training programs. The External Advisory Committee strongly recommends that an electronic database be developed so that the quality of incoming fellows (M.D.s, D.M.D.s, and Ph.D.s) can be evaluated and continually monitored. Statistics on entering fellows should include prior research training, publication record, grades, educational institutions attended, and results of standardized tests and/or national board scores. To determine efficacy of training within the IRP, a ten-year tracking system should be developed similar to that required of T32 NIH extramural training programs. Data should be obtained not only for M.D.s but also Ph.Ds.

Notes

1 *Report of the Task Force on the Intramural Research Program of the National Institutes of Health,* transmitted April 13, 1992 to Dr. Bernadine Healy, Director, National Institutes of Health, from Richard D. Klausner, Ph.D., Chief, Cell Biology and Metabolism Branch, National Institute of Child Health and Human Development, NIH.

2 In 1992, more than 50 percent of IRP postdoctoral trainees were foreign.

3 Henry Frierson and James Wyche, "Increasing Minority Biomedical Scientists Through The Physician-Scientist Route," *The Journal of NIH Research* 6(2):16-23, February 1994.

4 Of the Ph.D.s awarded in 1992 to underrepresented minorities, minority women received 49 percent of such awards in the life sciences. Over half of the underrepresented M.D. degree-holders in 1992 were women.

ORGANIZATIONAL ISSUES AFFECTING RECRUITMENT AND RETENTION

In its early years, the IRP had an aura of great prestige: positions in it were considered so desirable that the NIH had its pick of the best scientists in the Nation to carry out its mission of basic and clinical research. Many of these scientists then moved on to other institutions, establishing their own programs and becoming strong scientific competitors with the IRP. At the same time, the IRP was perceived to age and to become less attractive. As a result, it is now experiencing difficulties in recruitment and retention of senior scientists. The External Advisory Committee examined the causes of and potential remedies for this loss of competitiveness and its recommendations are consistent with the administrative mandate to "reinvent government."

Scientists initially are attracted to the NIH IRP because of the high quality of scientific colleagues and mentors and by the opportunity to commit full time to research without substantial obligations to non-research related teaching, patient care, and administration. The availability of stable research funding based on retrospective rather than prospective review is particularly attractive to those who desire an opportunity to explore new ideas in their earliest stages. In addition, the resources of the Clinical Center and the opportunity to conduct clinical research, as well as the prospect of interacting with outstanding scientists, add to the attractiveness of the intramural environment.

Many of the organizational complaints about the intramural program focus on personnel issues, including compensation and administrative barriers to a productive work environment. These issues are not new or unique to NIH, but are particularly troublesome where intellectual capital and scientific discovery are the mainstay and mission of the agency. Although recent attention has focused on the loss of several senior scientists from the IRP to other research institutions, it is far more remarkable that many other senior scientists remain at NIH despite burdensome bureaucracy and sometimes noncompetitive salaries.

Personnel

Salaries in the IRP have not kept up with salaries in extramural institutions, particularly for senior scientists and for physicians. Legislation has been passed allowing NIH to pay higher salaries for selected positions under Title 38, but NIH has not been allowed to implement that legislation. The legislation creates a Senior Biomedical Research Service (SBRS), intended to provide supplemental pay up to 110 percent of Executive Level I. Other avenues for employment of high level specialists—such as the Senior Executive Service (SES), Senior Scientific Service (SSS)—either have not been implemented or have been closed to further accrual. In addition, the approval process for all of these higher level positions takes too long and does not serve the purposes of a rigorous recruitment system.

The ability to recruit and retain junior and senior scientists and clinicians as well as talented support staff depends on a flexible pay and personnel system, free of undue complexity. NIH's current personnel system encompasses a multitude of hiring mechanisms, including PHS Commissioned Corps, SES/SSS, civil service, service fellowships, visiting fellowships, intramural research training awards, visiting associates, and visiting scientists. The complexity of hiring due to these varied mechanisms and the lack of broad personnel pay authority at NIH has often resulted in delays in hiring and loss of critical staff necessary to maintain a high quality research environment. Juggling these various personnel systems to staff the IRP with the best scientists available tests the skills of scientific directors and laboratory and branch chiefs.

Another barrier to recruitment and retention is the current federal retirement system. Many academic scientists are covered by systems under which retirement funds can be transferred from one institution to another. If portable retirement systems were available to intramural scientists, one barrier to recruitment would be removed, especially for mid-career individuals. It would also make it more attractive for mid- or late-career intramural scientists to seek other employment if their enthusiasm for research had diminished, and it would facilitate turnover within the IRP.

Scientists at universities have varied sources of temporary technical help which permit labor-intensive research. In contrast, technical assistance in the IRP is vanishingly small because technicians and laboratory assistants take up FTE slots that could be used for professionals. As a result, IRP scientists and their postdoctoral fellows spend time on tasks best performed by less skilled personnel, or contract for these tasks to be done by commercial organi-

zations at considerable cost. Neither approach is a wise use of valuable resources. The IRP should consider establishing some mechanism for employing technical assistants for short periods (e.g., up to three years) in untenured positions.

A major problem regarding personnel policy has arisen from the designation of the IRP as an administrative expense, and the resulting designation of scientists at the level of GS-14 and above—as well as their counterparts in the Commissioned Corps—as "managers" whose numbers must be drastically reduced under an executive mandate to reduce the size of the bureaucracy. In the IRP, the ranks of GS-14 and up are given to scientists with high technical skills in order to provide a salary that is appropriate to their professional standing. A GS-14 scientist is likely to have a small laboratory with a couple of postdoctoral fellows and technicians and responsibilities that correspond roughly to those of an associate professor at a university—far from the duties of a middle manager of an administrative office. The depletion of positions at the level of GS-14 and GS-15 will make it difficult to recruit, tenure, and promote talented young scientists for years to come. It is difficult to see how the IRP can hope to revitalize itself under these circumstances. Treating NIH bench scientists as equivalent to administrative members of the civil service results in actions instituted across the service irrespective of the actual job description.

The External Advisory Committee strongly opposes the recent decision to classify the IRP as an administrative expense. To designate the intramural programs as "administrative" could ultimately be destructive to the mission of NIH in that it makes it difficult, or impossible, to implement the recommendations related to assuring the quality of IRP personnel and projects detailed in this report. All efforts should be made to exempt the IRP from an administrative classification.

Procurement

The procurement process for the IRP is repeatedly cited as burdensome to the conduct of research. The ability to purchase efficiently—both in terms of cost and time—research supplies, equipment, and services is critical to a successful and competitive research enterprise. The complex procurement process often requires that scientists prepare lengthy justifications for purchases that must then go through prolonged clearance reviews. Current procurement policies and procedures require extensive documentation for the most simple purchase. For example, the policy requiring lists of alternative sources does not necessarily result in savings. In addition, many items could be purchased at less expense and with faster delivery from sources other than those required by the procurement system.

While it is clear that many of the procurement rules are targeted at saving federal dollars through competition, the impact of increased administrative oversight and increased paper work and delays in receiving materials result in lost research time by scientific staff and the cost of this reduction in productivity offsets procurement savings. This situation also can result in an increasing ratio of infrastructure to scientific personnel. Under current regulations, purchasing personnel must be distanced from the scientists placing the orders and communication between them must be limited. Designed to protect the government agency from appearing to favor one supplier over another, this distancing has resulted in deterioration of services from purchasing offices, which are considered slow and unresponsive. While acquisition of large equipment often is delayed pending availability of funds, such unavoidable delays often are aggravated by the slow processing of the orders. The situation is at its worst in the purchase of computer equipment, which must undergo additional layers of administrative approval.

The regulations governing procurement should be reexamined in the light of "reinventing government." The Vice President has directed a rewrite of the Federal Acquisition Regulations as part of the National Performance Review. It is expected that, if implemented, revisions in the procurement process would provide a welcome relief in the IRP. The NIH intramural program could serve as a model for developing and testing novel procedures to make the procurement process fast, efficient and responsive to research needs, while maintaining a high level of protection for the integrity of federal spending.

Laboratory Space

It has been felt for many years that many of the laboratory physical facilities at NIH are in poor condition. Modern safety requirements and constantly changing technologies further compromise the already decaying infrastructure (see the later discussion on the renewal of the Clinical Center). Overcrowding in less than modern facilities contributes to low morale and less than desirable productivity. Long delays in the renovation of office and laboratory space contributes to the uncertainty of research planning.

Most extramural visitors are shocked at the cramped quarters in which IRP staff must work. Many institutes report less than 250 square feet of net usable space per professional scientist, including common space for libraries, conference rooms, instrument rooms and cold rooms. This is substantially less than the space generally available in the extramural community. It would be fiscally impossible and scientifically undesirable to build enough space to accommodate all the activities that now

take place in the overcrowded IRP. More rigorous review, with prompt reduction or elimination of space for unproductive groups should help to generate space that would become available for distribution to the more productive scientists.

Specialized Facilities

Modern biomedical research increasingly depends on the availability of large and costly instruments that require experts for their operation. Major research universities maintain centers that service the needs of biomedical scientists for such procedures as peptide synthesis, protein sequencing, DNA sequencing, fluorescence activated cell sorting, and sophisticated microscopy. Most NIH intramural scientists are hampered by the lack of such facilities, although some institutes have their own. Institutes must either divert precious financial and personnel resources to operate their own, depend on the good will of colleagues who have such facilities, or obtain these services from commercial organizations. The External Advisory Committee urges that scientific directors organize institute-wide facilities.

The Committee notes that the situation is very different with respect to computer resources. The NIH Computer Center, for example, has for many years consistently provided up-to-date equipment, software, training and advice to IRP scientists, and could serve as a model for other such NIH-wide ventures.

Professional Interactions

One of the attractions of the IRP environment has been an "academic atmosphere," which includes free and open association with colleagues both inside and outside NIH. An increase in restrictions and regulations regarding travel budgets and outside activities severely compromise opportunities for intramural scientists to interact with their colleagues from other research institutions. Scientists report that they are discouraged—sometimes prevented—from taking part in affairs of professional societies and even from collaborating with extramural scientists. This differs among institutes, reflecting local interpretations of conflict-of-interest issues. A ban on honoraria for lectures clearly sets intramural scientists apart from their academic peers; it is considered by IRP scientists to be irrational since consulting is permitted.

Severe limitation on travel to scientific meetings increases the sense that IRP scientists are isolated from their peers in the extramural community; it is particularly damaging to young scientists who cannot afford to go at their own expense. Travel to scientific meetings should be viewed as a necessary and integral part of research.

RECOMMENDATIONS

1. **Recognizing that it is not within the authority of the Director of NIH to change the current classification of the intramural research program as an administrative expense, the Committee is strongly of the opinion that it should not be classified in this manner.**

Such a classification leads to budgetary procedures which are not rationally related to the scientific process and do not support the goal of achieving the highest quality and productivity in the intramural research program. This approach is inappropriate and counterproductive to recruiting, providing tenure, and retaining the highest quality research personnel. All efforts should be made to exempt intramural scientists from this classification.

2. **The Deputy Director for Intramural Research should establish a joint committee of IRP scientists and NIH administrators to review regulations and restrictions that isolate intramural scientists from their colleagues in the extramural community and to propose appropriate modifications.**

3. **NIH should be granted by the Department of Health and Human Services (DHHS) the authority, through the Senior Biomedical Research Service, to implement all actions necessary to recruit, hire, and pay scientists in a timely and appropriate manner.**

4. **NIH should be permitted to provide portable retirement systems to intramural scientists to remove a major barrier to recruitment, especially for mid-career individuals.**

Providing such systems would also make it more attractive for mid- or late-career IRP scientists to seek other employment if their enthusiasm for research had diminished and would facilitate turnover within the IRP.

5. **In the context of "reinventing government," opportunities exist to dramatically improve the flexibility in procurement procedures, appointment of staff, and allocation and use of laboratory space and research resources.**

NIH could serve as a model for developing and testing novel procedures to make the procurement process fast, efficient and responsive to research needs, while maintaining a high level of protection for the integrity of federal spending.

NIH-PRIVATE SECTOR COLLABORATIONS

Not infrequently intramural scientists at NIH perform basic or clinical research which can lead to the formulation of a biological material, drug, or device that can then be developed commercially. The process by which the results of this research are applied to health care is technology transfer.

More generally, technology transfer is the process by which results of research and development are applied and utilized in another area, organization, or commercial sector. The term can refer to the legal and administrative process by which the transfer of legal rights—such as the assignment of title to a patent to a contractor, or the licensing of a government-owned patent to a company—is achieved. Or, it can refer to the informal movement of information, knowledge and skill from a Federal laboratory to the private sector through person to person contact. The most crucial aspect of technology transfer, however, is the use of product- or process- technology in a new enterprise.

The Federal Technology Transfer Act of 1986 sought to promote technology transfer by authorizing government-operated laboratories, such as the NIH IRP, to enter into Cooperative Research and Development Agreements, better known as CRADAs,[1] with other federal agencies, state or local governments, and industrial and non-profit organizations. This law authorizes the Director of NIH to negotiate licensing agreements for government-owned inventions created in the IRP and for other inventions of NIH employees that may be voluntarily assigned to the Government. This provision allows inventors and laboratories to keep a percentage of any royalties paid on these licenses.

The wave of legislative and executive initiatives in technology transfer that swept the U.S. research enterprise in the 1980s continues to be evaluated. Although the number of CRADAs has increased over time at all agencies, the qualitative value of such agreements has not been fully assessed. Clearly the system is now more open and inviting to the private sector than it was before 1980, but recent analyses show that significant barriers remain on both sides of the technology transfer equation.

Recent congressional scrutiny of pharmaceutical industry research agreements with NIH laboratories and NIH-funded laboratories has focused on issues of patent ownership, drug pricing, and concern that academic-industry agreements may involve exclusive access to NIH-funded research. These concerns have led to inspection of the contract provisions in CRADAs as well as other types of research arrangements between NIH and the pharmaceutical industry. Increased attention on pharmaceutical price controls has also resulted in a "reasonable pricing" clause in all types of research arrangements between NIH and the pharmaceutical industry, including large NIH-initiated clinical studies of approved and marketed products.

It is important that the true purpose and scope of the CRADA as originally intended by the Federal Technology Transfer Act be followed by NIH and respected by industry; otherwise the goals of technology transfer are at risk. A CRADA is a formal mechanism by which relevant basic research knowledge is transferred to a commercial entity with the capacity and resources to utilize that information in the development of new drugs, preventives or diagnostics. The transfer of information is a collaborative research process characterized by an extensive two-way intellectual interchange and contributions toward a defined research workplan.

A CRADA should not be a mechanism to fund basic research in NIH laboratories nor should it be a mechanism by which NIH competes with the private sector. The mission of NIH is best served by conducting research in the laboratory and in the clinic. The return on federal investment in NIH research should not be judged on the amount of revenue the NIH laboratories generate.

1 As defined by the Federal Technology Transfer Act of 1986, a CRADA is any agreement between one or more federal laboratories and one or more non-federal parties under which the Government provides personnel, services, facilities, equipment, or other resources (but not funds) and the non-federal parties provide funds, personnel, services, facilities, equipment, or other resources toward the conduct of specific research or development efforts.

The CRADA Process: Information, Review, Approval and Implementation

A recent report from the Office of Inspector General of the Department of Health and Human Services identified several issues that have limited the utility and productivity of the CRADA system, particularly at NIH where the number of new CRADAs signed annually since 1988 has never exceeded 50 (compared to nearly 300 in 1993 at the U.S. Department of Energy) and where the average approval time is now 10 months (compared to less than two months at the National Institute for Science and Technology). The report concluded that while the NIH's inclusion of a "reasonable pricing" clause in CRADAs was a major factor in dampening the pharmaceutical industry's interest in this mechanism of technology transfer, the other major impediments to a more successful CRADA program concerned process issues: inappropriate selection of research projects for CRADAs, the lengthy and complex procedures to establish a CRADA, inadequate advertising of CRADA opportunities, the absence of a central database to track CRADAs, and limited NIH oversight of the process.

Advertising of CRADA and Other Licensing Opportunities

The Inspector General noted that the NIH procedures for dissemination of information about CRADA opportunities or the CRADA process do not provide adequate "fair access" to such information for potential commercial partners and that limited and select distribution or access to CRADA opportunities could undermine the industry's interest in the CRADA system, impede market competition, and erode public support.

PHS does publish an annual Technology Transfer Directory that lists CRADA opportunities and other research tools or inventions available for exclusive or non-exclusive licensure, and organizes periodic technology transfer workshops where NIH scientists present research projects that are available for cooperative agreements or other licensure. However, the PHS directory is of limited utility since projects are merely "listed"—150 pages of abstract after abstract—and not well-organized in terms of either therapeutic or research tool categories. The directory does have sections on existing CRADAs and model CRADAs with boilerplate language, but does not fully explain the purpose, expectations and responsibilities of the respective collaborating parties.

Establishment of a CRADA—Review and Approval

The review and approval of a CRADA at NIH is a time-consuming, cumbersome and unnecessarily complex process. The process requires scientific, policy, legal, commercial and administrative review.

At the laboratory level, the NIH investigator and the proposed collaborator, in conjunction with the institute's technology development coordinator, develop a CRADA based on a research plan. The institute's coordinator orchestrates the entire review process of each CRADA and serves as advisor to the NIH investigator. The CRADA must then be approved by the laboratory/branch chief as well as the coordinator.

At the institute level, the CRADA is reviewed by the scientific director for scientific merit, consistency with the institute's research mission, allocation of financial and staff support, and conformity of intellectual property contributions with NIH CRADA policy. The institute's ethics officer reviews the CRADA for potential conflict-of-interest issues.

At the NIH level, the CRADA is reviewed by the Office of the General Counsel, the Office of Technology Transfer, and then the NIH CRADA Subcommittee. If the CRADA does not deviate from the standard CRADA model, it is reviewed by the NIH CRADA Subcommittee but does not need further review.

The CRADA Subcommittee advises the NIH Director on specific CRADAs and CRADA policy. The CRADA Subcommittee is comprised of the NIH senior scientists, institute-level executive officers, the Director of the NIH Office for Technology Transfer, and the NIH General Counsel. The subcommittee's review focuses on the scientific, legal, and administrative policy aspects of the CRADA and its impact on the basic research mission of the NIH laboratory. The CRADAs recommended for approval by the subcommittee are forwarded to the NIH Director for review. CRADAs that are approved by the NIH Director are returned to the institute director for final signature.

Once CRADAs are established, all ongoing CRADA research undergoes periodic peer review within the institutes by the boards of scientific counselors to ensure and maintain the highest quality of research conducted in the intramural research program at the NIH. Review by the BSC is not required for the initial approval of the CRADA.

The average time to establish a CRADA is 250 to 350 days. Clearly this process would benefit if it were streamlined.

Implementation of CRADAs and Cost of Maintaining Patents

The costs of filing patents arising from CRADA research and the costs of maintaining the patents once issued are significant. The question has been asked whether costs could be reduced by changes within NIH in reviewing which patents to file and in ensuring the expeditious handling of applications.

Access to Research Tools

Licensing of inventions under CRADAs should distinguish commercial use from research use. Licenses for research use should be on a non-exclusive and reasonable basis in order to make research tools broadly available. Exclusive licensing of research tools creates impediments to the advancement of medical science.

Non-Exclusive Licenses for Research Tools

A policy that promotes open and broad access of research tools discovered or created in the NIH laboratories, with the appropriate remuneration to the laboratory under a non-exclusive license, would foster competition among commercial laboratories to discover and ultimately develop human health products, thereby meeting the congressional intent to spur technology transfer that benefits the public health and improves the U.S. position in a global economy. Exclusive licensing of government inventions for the commercialization of products and processes under a CRADA is necessary to encourage cooperative research between NIH and commercial entities, but such inventions should be licensed on a non-exclusive basis for research use. Through non-exclusive licenses, and for reasonable fees, the NIH should strive for rapid notification, evaluation and licensure to academic and commercial laboratories on a broad basis.

Procedural Problems In Acquiring Research Tools

In addition to promoting a policy of non-exclusive licensure of research tools for research purposes, the NIH also should enhance the speed and efficiency of the process of granting non-exclusive licenses. The procedures to procure cell lines or clones from NIH on a non-exclusive license basis are bureaucratic and cumbersome. Such procedures do more to block the transfer of basic research tools than to facilitate such transfer, ultimately delaying the research process.

Reasonable Pricing Clauses within CRADAs

The report from the DHHS Office of Inspector General acknowledges that Congress did not address the issue of pricing in the Federal Technology Transfer Act. NIH has incorporated a reasonable pricing clause within its model CRADA. Several pharmaceutical companies have refused to participate in CRADAs due to the reasonable pricing clause and some have convinced NIH to modify or limit the clause in their CRADAs. Such clauses discourage technology transfer and the development of new therapeutic products by imposing pricing restrictions that may limit the ability of a company to recover its costs of research and development. Royalty provisions or payments to reimburse the government laboratory for its costs or, in appropriate circumstances, the supply of clinical materials (rather than restrictions on the pricing of products) may be more appropriate mechanisms to fairly and appropriately compensate the government laboratory for the use of its technology in commercial development.

RECOMMENDATIONS

1. **To ensure that the NIH intramural program is fulfilling its mandate to facilitate technology transfer NIH should broadly communicate in a clear and precise manner the scope, purpose and definition of a Cooperative Research and Development Agreement.**

2. **NIH should create a readily accessible centralized database which contains CRADA and other licensing opportunities throughout all the institutes.**

3. **NIH should develop and publish a practical guide that explains both the substance and process of CRADAs and other licensing opportunities at NIH and further, should develop a mechanism to assure broad dissemination of the guide to the relevant commercial audiences.**

4. **NIH should be more accountable for the timely and efficient review and approval of CRADAs.**

With the establishment of a centralized database to track the development and review of a CRADA, much of the review could be completed electronically. NIH should consider conducting the various layers of review in parallel rather than sequentially to shorten the approval process.

5. **NIH should fully promote and utilize the "Letter of Intent" CRADA, introduced in 1993, which only takes a few weeks to prepare and allows collaborative research work to begin rapidly.**

Any invention made prior to the implementation of the full CRADA is retroactive and the parties' intellectual property rights are protected.

6. **NIH should continue plans to implement an improved system to manage and track the filing of patent applications, and develop training programs for NIH staff to improve the quality of the applications and the efficiency of the process.**

Where patent rights are exclusively licensed to a commercial collaborator under a CRADA or other research agreement, the commercial partner should bear the cost of patent filings (or at least contribute in part).

7. **NIH should develop and implement a clear statement of policy that promotes the non-exclusive licensure of basic research tools to academic and commercial laboratories for research purposes.**

When non-exclusive licenses for research tools are granted, a pro rata sharing of patent filing costs among all commercial licensees may be appropriate.

8. **NIH should examine its procedures for handling requests for non-exclusive licensure of basic research tools for research purposes to assure that the process facilitates rapid and broad access to research tools to enhance, not impede, both biomedical research in academic and industrial laboratories and subsequent commercial development of important technologies to improve human health.**

9. **The NIH CRADA Subcommittee should periodically conduct a comprehensive review of all existing CRADAs that have been established to determine whether: 1) truly useful technology transfer that will benefit public health has resulted from the CRADA system; 2) the CRADA system has been an efficient use of both government and private resources in transferring new technologies; and 3) the CRADA system has had an adverse impact on the basic research mission or funding of laboratories that have participated in CRADA projects as well as those that have not participated.**

10. **Considering the controversy over the inclusion of reasonable pricing clauses in CRADAs, NIH should convene a public meeting with all interested parties and constituencies from the public and private sectors to specifically address resolution of this issue.**

PROCESS FOR ALLOCATING FUNDS BETWEEN THE EXTRAMURAL AND INTRAMURAL PROGRAMS

The preeminence of the United States in biomedical research over the past half~century can be attrib-uted, in large part, to the dual intramural/extra-mural research programs of NIH. The IRP employs career scientists in a centralized location where they engage in long-term programs of research that the Government deems advisable. The ERP provides relative-ly short-term grants to individual scientists for the perfor-mance of specific projects proposed by the scientists and approved through peer review. The extramural scientists are employed by universities, colleges, or research insti-tutes, and their NIH grants support them only for the pro-portion of time that they devote to the approved projects.

Decentralization of the ERP allows NIH to tap the cre-ative energies of tens of thousands of scientists who are independent of the federal bureaucracy. This system is ideal for young investigators who use their NIH grants to explore unorthodox ideas free from the scientific preju-dices of an older generation.

Decentralization of the ERP has an additional benefit that may even outweigh its direct scientific output. NIH-supported extramural scientists form the backbone of the national educational *effort* in biology and medicine. Rather than being sequestered in government laborato-ries, these scientists are involved daily in teaching and encouraging the development of future scientists. Young people *from* all 50 States have access to these scientists, allowing the research effort to acquire creative input from every corner of the country.

The IRP complements the ERP. The very virtue that makes the ERP a success, its decentralization, carries a potential weakness-that of isolation. The Nation needs a centralized location, such as that provided by the IRP, where scientists trained in various parts of the country can work together, thereby reaping the benefit of cross-fertilization among disciplines. One of the greatest intra-mural successes has been the Clinical Associate program, which attracts young clinically-trained individuals from around the country and juxtaposes them with career sci-entists at NIH. Out of these contacts have come a great number of fundamental discoveries.

The IRP provides a place where scientists can receive long-term career support not necessarily tied to any spe-cific project. It also provides a place where teams of sci-entists can be mobilized at short notice to respond to new challenges, such as AIDS, that might arise suddenly. It provides a place where patients can be gathered from around the country and studied scientifically, in the absence of the economic and academic pressures that affect teaching hospitals.

From the above considerations and others it is clear to the External Advisory Committee that a vigorous national biomedical research effort requires a balance between the extramural and intramural programs. Maintaining this balance has become more difficult in recent years due to several factors: 1) the failure of the overall NIH budget to keep pace with the growth of the extramural community, which has placed great constraints on the funding of new and continuing projects; 2) mandated but not funded programmatic initiatives; and 3) the phys-ical decline of the Clinical Center which is placing new demands on the intramural budget. Given these pres-sures, the processes by which allocation decisions are made across the extramural and intramural programs are more critical.

The External Advisory Committee strongly recommends that these factors be addressed and resolved, but not at the expense of either the ERP or the quality programs of the IRP This means that the funding for the renewal of the Clinical Center must be obtained largely from the redirection of funds that would otherwise have supported lower quality intramural programs, plus additional fund-ing earmarked specifically for renewal of the Clinical Center. In other sections of this report the Committee recommends a review process that identifies for the pur-pose of downsizing intramural programs that are no longer competitive.

In requesting special funding for renewal of the Clinical Center, NIH must not forego increases that would other-wise have been directed to the ERP. Every effort must be made to increase funding of the ERP to support biomed-ical advances and to facilitate the influx of fresh new minds into the national biomedical research establish-ment.

From a budgetary perspective, the proportion of the NIH appropriation allocated to the IRP has remained essen-tially constant at 11.3 percent for the past decade, *despite* the fact that the size of the extramural research commu-

nity has expanded at a more rapid rate than the IRP. Questions also have been raised about whether some of the research conducted in the IRP could be done equally as well in the extramural program, reserving for the IRP those research activities that can be more readily and effectively pursued intramurally. These are complex and significant questions, particularly in the face of sometimes competing goals of deficit reduction and the acquisition of new knowledge. The issue of whether the allocation of resources between the IRP and ERP is balanced and appropriate is made all the more important by virtue of the concerns in the extramural community regarding availability of NIH funding, particularly for young investigators.

At the present time, the Committee could discern no consistent policy for all ICDs for allocating resources between the intramural and extramural programs. Most ICDs use a variety of mechanisms including external advisory committees, internal committees, Congressional directives, and less formal mechanisms to set scientific priorities and resource allocations. A few institutes, such as the National Institute for Allergy and Infectious Diseases, have well-articulated procedures based on active planning processes for making allocation decisions in a prospective manner. Such planning processes consider the most rational and cost effective intramural component to carry out new or existing projects.

In other cases, institutes appear to have maintained the same rate of growth in their intramural programs as for the total institute budget without employing a rigorous process of determining research priorities. Thus, historical distribution of funds becomes in part a rationale for current decisions.

The External Advisory Committee believes that the allocation of resources between the intramural and extramural programs must be conducted on an institute-by-institute basis because of: 1) the differing missions of each ICD; 2) changing opportunities and needs; 3) available skills, expertise, and resources required to address particular scientific problems; and 4) changing research resources in the IRP and ERP.

While the Committee believes that the NIH planning process should be sufficiently flexible to accommodate specific needs of individual ICDs, certain minimal standards applied across all ICDs are essential. The Committee strongly recommends that a formal, written process for allocating resources between the extramural and intramural programs be established for all of NIH; a model for such a process might be that used by NIAID. In doing so, a critical principle must be emphasized; that of maximizing the use of scarce resources in solving problems in health and health sciences. Because institute budgets are appropriated by Congress without regard to the extramural/intramural allocations it is incumbent on NIH to extend its own oversight of this process.

In addition, any decision to shift funds between the intramural and the extramural programs must reflect the more judicious use of funds in support of biomedical discovery and the public's potential benefit. The process of resource allocation, in the final analysis, should be based on judgement by the best available experts in the particular area of biomedical research. Such expertise should be drawn from both the intramural and extramural communities.

The Committee believes that the public, Congress, and the scientific community can be best assured that the allocation of resources between the extramural and intramural programs is appropriate if there is full and open consideration of these decisions by the intramural leadership in cooperation with representatives of the extramural community. Institute and scientific directors must exhibit leadership and identify promising areas of research for either the intramural or the extramural program. The Committee believes that a more open process will strengthen the outcome of research investment without in any way interfering with the leadership of the intramural scientific community.

The Committee emphasizes the severe difficulties posed in making allocation decisions by the recent decision by the Office of Management and Budget, congressional appropriations committees, and DHHS to classify the NIH intramural research program as an "administrative expense," rather than as a "program of research," similar to the extramural research program. This decision is counter to an agreement reached several years ago by NIH, the congressional General Accounting Office and the House Energy and Commerce Committee to classify the IRP as a "program of research." The classification of the IRP as administrative subjects it to an Executive Order to reduce "supervisory" personnel, a classification which would be assigned to working scientists without significant supervisory responsibilities.

The External Advisory Committee strongly opposes the decision to classify the IRP as an administrative expense. This approach is inappropriate and counterproductive. The Committee suggests that a more appropriate mechanism for improving the cost-effectiveness of the IRP is through thorough quality review rather than across-the-board reductions. If the overall NIH scientific mission is to be assessed and allocation decisions are to be made on the basis of scientific excellence and opportunity, then identifying a portion of the research mission as "administrative" is artificial and misleading, and leads to budgetary procedures which are not rationally related to the

scientific process and do not support the goal of achieving the highest quality and productivity of the IRP. The intramural and extramural programs should be considered integrated and complementary investments in improving the Nation's health. To designate the intramural programs as "administrative" could ultimately be destructive to the mission of NIH in that it makes it difficult, or impossible, to implement the recommendations related to assuring the quality of IRP personnel and projects detailed in this report.

What should be the ultimate outcome in terms of balance of intramural and extramural programs? A more rigorous review of quality is likely to produce restructuring of the current intramural program. Low priority programs should be reduced or terminated. High priority programs may benefit from increased resources. In the current fiscal climate it is unlikely that there will be a substantial increase in overall resources for the intramural program. Public interest demands that the size of the intramural program be governed by excellence, opportunity, need, and ability to respond quickly to crises, such as that represented by the AIDS pandemic. A thoughtful and well-conducted prospective planning process for determining the intramural allocation, such as that outlined below, will achieve an effective balance.

RECOMMENDATIONS

1. **The intramural/extramural resource distribution should be based on an annual prospective planning process carried out by each ICD.**

The process should be outlined in a written document and reviewed, approved, and monitored by the NIH Director and the Advisory Committee to the Director, NIH. Extensive consultation with the extramural research community should be part of this process. The overall NIH scientific mission should be assessed and allocation decisions made on the basis of scientific excellence and opportunity.

The planning process for each ICD should involve a rigorous review by the BSC of the quality of all of the intramural research activities within that ICD, including a ranking of the relative merit of all intramural programs, comparable to methodologies used in the extramural program. Minimal criteria to be used in considering programs for intramural funding include: a) availability of intramural investigators of outstanding quality; b) special resources or personnel unique to the IRP which are related to specific research objectives; c) the time required for a rapid response to urgent research questions; d) the need of the ICD to maintain a research activity of quality; and e) the requirements for adequate research training of young intramural scientists.

2. **The planning process should include a review of resource allocation for the IRP by a committee chaired by the Director of NIH which includes the Director of the IRP, chairs of the institutes' boards of scientific counselors and, if the Director of NIH deems it desirable, a representative of the Director's Advisory Committee. The results should be communicated to the councils of the appropriate institutes.**

This review should be done in a timely fashion with recommendations regarding resource allocation made to the scientific and institute directors and the NIH Director. Quality assessment and the potential for success of the programs pursued in the IRP should be the primary criteria for these recommendations.

Following this review, each institute director should be responsible for implementing the allocation of intramural and extramural budgets, as is the current practice. In an ongoing review of the intramural budget, the institute director should assess the percent of the budget devoted to personnel, travel, training, supplies, equipment, and contract services.

3. **Annually each institute or center director should provide to the NIH Director projections of intramural compared to extramural funding as well as the specific rationales on which they are based.**

4. **After final appropriation, the NIH Director should be given the discretion to recommend the reallocation of funds based on perceived timely needs and scientific opportunity. This flexibility should not exceed five percent of the IRP budget of any given ICD.**

5. **A criterion used to evaluate the performance of an institute director should be the management of the extramural/intramural allocation process.**

An additional criterion should be the extent to which the director developed formal programs to promote interactions between intramural and extramural scientists. Results of the evaluation, which should occur at least biannually, should be reported in writing.

6. **Each ICD should have in place a formal process to implement the above recommendations in a manner that will allow the NIH Director—with input from the Director's Advisory Committee—to certify immediately, or at least by January 1, 1995, that appropriate procedures and policies are in place.**

7. **In the context of these recommendations, a centralized decisionmaking process governing the total NIH extramural/intramural allocation should ensure that the total intramural research program budget for institutes, centers, and divisions does not exceed the current rate of 11.3 percent of the total NIH budget.**

This percentage should be reviewed through the process outlined in recommendations number 1 and 2 above, following *full implementation* of the recommendations which emerge from the quality review of the intramural program as detailed in this report. It is anticipated that implementation of this process of quality assurance may require 3 to 4 years.

RENEWAL OF THE CLINICAL CENTER

With over 1.3 million square feet, the original Clinical Center complex of NIH opened in 1952 as one of the world's premier biomedical research facilities. Few things distinguish the IRP from the ERP more than the presence of the Clinical Center, with its laboratories, hospital, and outpatient clinics designed to facilitate clinical research (see Table 1). The ability for long-term follow-up of patient populations from across the country, relatively stable funding, and a broad range of laboratory research and support systems have allowed for the development and detailed studies of diagnostics and therapeutics as well as basic clinical research about the causes and courses of disease. A central goal of the work of intramural clinical investigators is the application of basic laboratory advances to clinical application.

The Clinical Center facilities have been the site of many productive, pioneering studies, including some that were congressionally mandated. Such studies include investigations of alpha-1-antitrypsin deficiency, cystic fibrosis, gene therapy for severe combined immunodeficiency and thalassemia, immunotherapeutics in cancer, AIDS therapeutics, bone marrow transplantation, and development of enzyme therapy for Gaucher's disease. The many drugs and diagnostic tests which have been developed as a result of clinical studies conducted in the Clinical Center are evidence of the substantial achievements of the IRP. These include the development of IL-2 and its clinical applications, the AIDS diagnostic test kit, a number of unique monoclonal antibodies, vaccines and gene therapies, anti-AIDS drugs, anti-cancer drugs, and the use of growth factors in bioregulation techniques to improve imaging.

Size and Budget of the Clinical Center Complex

The Ambulatory Care Research Facility, completed in 1980, was the first major addition to the Clinical Center since its construction in 1952. Other additions have occurred over the years and the Clinical Center complex today is approximately 3 million gross square feet (1.8 million net square feet). The complex comprises approximately 40 percent of the total space on the NIH campus and forms the core of the clinical research component of the NIH intramural program.

Of the total IRP FY 1992 budget of approximately $973 million, $305 million was expended for clinical research (approximately 31 percent). The portion of the Clinical Center budget directly related to patient care included an operating budget of about $250 million, including expenditures for collateral support.

The Clinical Center hospital is approximately 31 percent of the Clinical Center complex (just over 1 million gross square feet). Inpatient space represents 34 percent of the hospital (originally designed for 540 beds); outpatient space represents 12 percent of the hospital, or 126,000 gross square feet; core facilities represent about 54 percent of the hospital or 551,000 gross square feet.

Need for Renewal of the Clinical Center Complex

In recent years, it has become clear that the infrastructure of the Clinical Center is deteriorating. A comprehensive study of the infrastructure systems was conducted by an independent engineering firm and reviewed by NIH staff after NIH maintenance personnel reported that major mechanical systems that support both research and patient care would exceed their service life within the next few years and could no longer be properly maintained. In addition, an independent technical evaluation of plans for renewal of the Clinical Center was conducted by the U.S. Army Corps of Engineers as a result of a congressional request. The structural problems identified by these studies include mechanical and electrical deficiencies, the presence of hazardous substances, and physical constraints to renovation.

NIH reports that as a result of this decay research initiatives have been restricted and safety concerns have increased. In addition, intramural scientists complain that there is crowding in laboratories in the Clinical Center.

In the course of this review, members of the External Advisory Committee toured areas of the Clinical Center and saw vivid evidence of deterioration of the infrastructure and laboratories, as well as areas where renovation had restored facilities to an attractive and good working environment, although presumably requiring additional infrastructure upgrading. The decaying infrastructural

core of the Clinical Center supports a majority of the research laboratories as well as all of the inpatient nursing units.

Considerations in the Renewal of the Clinical Center Complex

Over the past three years NIH has evaluated various options for resolution of the Clinical Center's structural deficiencies. Four options for renewal were presented to the External Advisory Committee, ranging from no new construction to total replacement of the existing facilities, with cost estimates between $874 million and $1.2 billion (see discussion below).

In considering the needed size of a renewed Clinical Center inpatient facility, the Committee considered: 1) current protocol activity; 2) the characteristics and quality of active protocols; 3) occupancy rates; 4) trends toward implementation of new protocols in an ambulatory setting; 5) the need for specialized units (e.g., for pediatric protocols, immunosuppressed patients, transplantation protocols); and 6) the relationship of IRP protocols to extramural programs.

In considering the renewal requirements for the Clinical Center research facilities, the Committee also considered: 1) the current conditions of the research facilities; 2) the need for proximity between the patient care and laboratory facilities; and 3) the quality and size of the clinical research program. Issues affecting quality, such as those discussed in previous sections of this report, were an integral part of the evaluation.

In addition to the above considerations, the recommendations found in this report are based on: 1) testimony from scientists, institute directors, scientific directors, Clinical Center staff, and NIH administrative staff; 2) extensive documentation provided to the Committee; 3) invited written comments of members of NIH professional staff; and 4) site visits to the Clinical Center.

Findings of the Committee

Use of Patient Care Facilities

The Clinical Center hospital was originally designed for 540 beds: The available beds in FY 1993 varied from 385 to 417.[1] In evaluating the current operating size of the Clinical Center hospital, the Committee received testimony that the current budget provided staffing for 84,000 patient days or an average daily census of 230 patients. In FY 1993, there were 80,000 patient days with an average length of stay of 9 days. In addition, there were 83,000 outpatient visits.

The Committee received a detailed analysis of the average inpatient occupancy by institute and day of the week in FY 1993. Based on the 422 beds available for most of that year, the highest occupancy rate was approximately 58 percent on any given day, with variability among the institutes. Beginning in FY 1995 the ICDs will pay for space they are assigned whether or not their beds are occupied. The Committee was told that a number of factors have influenced the occupancy rate over time, including a trend toward shorter patient stays and increased utilization of the Ambulatory Care Research Facility for clinical research. On a daily basis additional factors contribute to occupancy, such as the frequent need to limit room occupancy to one patient, and the specialized research and patient care needs of particular institutes. Staffing complements are designed for the number of patient days in the hospital as well as the projected needs of the institutes.

Clinical Research Protocols

Laboratories are physically close to clinical space and training activities emphasize a merging of basic research and conventional clinical skills. The clinical programs involve extensive collaborations among research groups at NIH. As of December 1993, 811 protocols were active in the Clinical Center involving 20,136 patients. Of these protocols, 50 percent are of a therapeutic nature, 35 percent concern the pathogenesis or natural history of a disease, and 15 percent are evaluating new diagnostic procedures. Eighty-five percent of the therapeutic trials are Phase I or II clinical trials.[2] Three institutes are performing phase III or phase IV clinical trials. During FY 1993, 175 new protocols were initiated and approximately the same number were discontinued.

Evaluation of the quality of the clinical research protocols conducted in the Clinical Center was beyond the scope of the Committee's work. Nevertheless, the Committee believed it necessary to obtain an estimate of the quality of protocols underway in order to better judge proposed plans for renewal of the facility. To do this, the ICDs were asked to prioritize their active clinical protocols. Each ICD using the patient facilities of the Clinical Center complied with this request. The Division of Cancer Treatment of the National Cancer Institute—which has the largest number of active protocols—used a scoring scale of 1 to 4 as follows:

1. The very best, unique, innovative trials with strong laboratory support.

2. Good but perhaps not unique protocols.

3. Investigational questions of average importance, generally lacking a laboratory basis and not using any resources unique to the Clinical Center.

4. Protocols representing poor or obsolete ideas.

The criteria used to assign a priority to each active protocol included: 1) alignment with the NIH and Clinical Center missions; 2) the extent to which the protocol represents cutting-edge science; 3) whether the Clinical Center environment is uniquely appropriate for the study; 4) whether the protocol addresses a national public health emergency; 5) the importance of the protocol to training; 6) whether the protocol is crucial to the institute's research program; 7) whether the protocol is likely to contribute to patient care or patient comfort; and 8) whether the protocol attempts to improve the efficiency or cost effectiveness of patient care.

Using these criteria, the Division of Cancer Treatment assigned to approximately 15 percent of all active protocols a priority score of 4, and another 35 percent of the active protocols a priority score of 3. Only about 50 percent of the active protocols were ranked with a priority score of 1 or 2, representing protocols considered good to the very best. The External Advisory Committee felt that only protocols deemed very good to outstanding should be supported by the resources of IRP, given the limited facilities and funding.

Options for Renewal

The Committee was initially presented by NIH with four options for renewal of the Clinical Center. These options were premised on: 1) maintaining the current level of programs; 2) providing a safe and efficient infrastructure system; 3) minimally disrupting patient care programs; and 4) minimally disrupting ongoing research activities within the Clinical Center. The options included:

Option A: New Inpatient Hospital and Laboratories/ Reuse of Existing Laboratories

Option B: Total Replacement Facility

Option C: New Clinical Research Facility/Reuse Existing for Basic Laboratories

Option D: Reuse Existing Facility/No New Construction

After review of each of these options, the Committee concluded that none were adequate and appropriate given the anticipated program requirements and budget constraints. Specifically, the Committee concluded: 1) an inpatient facility smaller than the current size would be adequate for foreseeable future IRP needs; 2) total replacement of the Clinical Center complex was neither necessary nor desirable; and 3) a phased program of renewal would be consonant with a long range strategic plan to implement more rigorous quality assurance for research programs of the IRP.

The External Advisory Committee requested that NIH develop additional options for a modular approach to renewal with greater consideration for containing costs. The following additional options were presented.

Option I: Early stage replacement of 50 percent of the Clinical Center research laboratories, early stage replacement of the hospital to accommodate 300 beds, and acquisition of the Uniformed Services University of Health Sciences facility, including required upgrade and operating costs for that facility.

Option II: Early stage replacement of 50 percent of the Clinical Center research laboratories, early stage replacement of the hospital to accommodate 200 beds, and acquisition of the Uniformed Services University of Health Sciences facility, including required upgrade and operating costs for that facility.

Option III: Early stage replacement of 50 percent of the Clinical Center research laboratories, early stage replacement of the hospital to accommodate 300 beds, and time and cost involved in upgrading existing research laboratories in the Clinical Center.

Conclusions

Upon analysis of the programs of the Clinical Center facility, the External Advisory Committee is strongly of the opinion that the Clinical Center is essential to the intramural research program. The Committee recognizes that a crucial asset of the Clinical Center complex is the flexibility it offers to respond to new opportunities and needs by rapid redirection of resources, such as with research on human immunodeficiency virus, breast cancer, and prostate cancer. Because the Clinical Center is not obligated to provide all types of clinical services, it can more readily redirect resources to new, innovative areas of research. In addition, the existence of a high caliber staff, on-site, with expertise in clinical research, allows for the rapid implementation of new initiatives.

The Committee also recognizes that the Clinical Center, with its appropriate facilities and support staff, allows scientists to conduct long-term clinical studies of individual patients and large families that would be difficult, if not impossible, to do in the extramural community because of the lack of sufficient and long-term funding. It also provides an excellent setting for the training of clinical investigators.

The External Advisory Committee agrees with the need for renewal of the Clinical Center. The question is not whether it should be renewed but what is the most appropriate plan for renewal of the facilities that would meet the needs of the intramural research program and be as timely and affordable as possible.

Based on the findings described above, the Committee concluded that the plan for renewal of the Clinical Center hospital should be based on a target of 250 beds. There are several reasons for selecting this number of beds, not the least of which are the current relatively low occupancy rate of 58 percent and the number of very good to outstanding clinical protocols active at any one time. The accepted historical philosophy of rigidly dedicating a set number of beds for each institute is no longer acceptable, necessary, nor cost effective. There is both the potential and need for greater efficiency in use of the Clinical Center patient facilities through carefully developed procedures that minimize the need to assign specific beds to specific institutes without sacrificing the quality or implementation of clinical studies.

The Clinical Center staff already has developed thoughtful plans for creating a more flexible nursing/technical staff and a more centralized management system. In addition, current trends toward more outpatient care and less inpatient care will reduce the demand for beds. Finally, if the IRP moves toward reducing the number of clinical protocols ranked as "poor" or "obsolete" and rigorously employs the quality review processes recommended in other sections of this report, the demand for beds will decrease as downsizing occurs. Procedures to improve flexibility and quality will be required in response to the administrative mandate requiring reductions in staff. The External Advisory Committee is confident that Clinical Center staff are already moving in an efficient and well thought out direction toward downsizing.

With regard to the research laboratories in the Clinical Center, it is clear that many are overcrowded and in need of renovation. The Committee was concerned by the failure of NIH to maintain the physical plant of the Clinical Center. In part, this may reflect a lack of funds, but it also may reflect misplaced priorities or a lack of commitment to improving the physical infrastructure on the part of leadership. Institutes have varied considerably in the amount of funds expended for necessary maintenance and renovation.

In response to a Committee inquiry, several institutes indicated that the adjacency of beds and laboratories was of considerable value in facilitating translational clinical research because of enhanced interaction among basic and clinical scientists. In total, the ICDs estimated that approximately 49 percent of the laboratory facilities of the Clinical Center are placed on the same floor as the relevant clinical facilities. This provides for convenience, speed, and efficiency in pursuing research objectives. The ICDs further indicated that it would be desirable if an additional 38 percent of their clinical facilities and laboratories were in the same building but not necessarily on the same floor.

In the experience of members of the External Advisory Committee, this is an unusually high configuration of close proximity between laboratory space and inpatient nursing units. Based on experience in the extramural community and testimony of scientists who are or were located in Clinical Center laboratories, it is difficult to justify high levels of immediate adjacency compared to relative adjacency (e.g., within a 15 minute walk) if substantial incremental costs are required to achieve such immediate adjacency in the renewal of the Clinical Center research laboratories. It is likely that a rigorous analysis of the extent to which laboratory facilities must be immediately or closely proximal to clinical facilities would result in a proximal space requirement substantially less than the current Clinical Center configuration.

RECOMMENDATIONS

The External Advisory Committee recommends that additional options be developed for renewal of the Clinical Center taking into account the conclusions outlined above. A phased program of renewal of the Clinical Center should be developed consistent with the following specific parameters:

1. **An inpatient nursing facility of 250 beds as a new building physically proximate to the existing Clinical Center. The plans for and construction of this facility should proceed as promptly as possible.**

2. **The Deputy Director for Intramural Research should conduct a review to determine the portion of research laboratory facilities currently housed in the Clinical Center which require immediate adjacency to the inpatient nursing unit.**

Such a review should be conducted as soon as possible by a committee chaired by the Deputy Director for Intramural Research and composed of experts from within NIH as well as scientific and facility experts from outside NIH. The criteria for justifying immediate adjacency of research laboratories to the inpatient nursing unit should be based on analysis of programs and evidence of substantial benefit to patient related research. Such justifications must be developed with the understanding that trade-offs must be made concerning costs of new construction of adjacent research laboratories. Following development of a program based on required adjacency, a plan for appropriate construction or renova-tion of the Clinical Center laboratories should be devel-oped by architects.

3. With the swing space created by the completion of recommendations 1 and 2, a long range plan for upgrading and maintaining the research laborato ries and ambulatory care space of the Clinical Center should be developed. This will allow phased renovation of laboratory space not included in the new construction.

4. In considering each new proposed research protocol for the Clinical Center, an explicit procedure should be in place to determine the feasibility of development and implementation of the clinical research plan using all available resources in both the Clinical Center and appropriate facilities in the extramural research program.

7. If, upon renewal of the Clinical Center, inpatient nursing units and laboratory research space become available in excess of the needs of the ongoing programs of the Clinical Center,, establishing priority for the use of such space should be the discretion of the Director of NIH with the understanding that priority should be given to programs currently housed off the Bethesda campus (both clinical facilities and research laboratories). Such consolidation of ICD programs should facilitate quality control and could reduce the costs of such programs.

Notes

1 It should be noted that in addition to beds available to the IRP in the Clinical Center hospital, the National Cancer Institute has 13 beds located in the Frederick Memorial Hospital in Frederick, Maryland; the National Institute on Aging has 11 beds located in the Gerontology Center in Baltimore, Maryland; the National Institute on Drug Abuse has 26 beds located at Bayview Research Campus in Baltimore, Maryland; the National Institute of Mental Health has 40 beds located at St. Elizabeth's Hospital in Washington, D.C.; and the National Institute for Child Health and Human Development has a new perinatal center at Georgetown University in Washington, D.C. In addition, the National Cancer Institute has partial access to a 20-bed hospital operated by the U.S. Navy, the use of which has been variable. The Committee did not have an opportunity to adequately evalu-ate the use of these off-campus inpatient facilities in order to make recommendations regarding future plans for their use.

2 Twenty-five clinical trials are being conducted in off site IRP facilities.

5. The Committee believes that funds for renewal of the Clinical Center should not be obtained by reducing budgets committed to the extramural research program or from funds allocated to quality programs of the intramural program.

Funds recovered from phasing out weaker intramural research programs should be used to the extent possible to fund renewal of the Clinical Center. To the extent that ftmds recovered from phased-out intramural programs are not adequate to meet the costs of renewal of the Clinical Center, the Committee recommends that an additional allocation of funds be targeted by Congress for this purpose.

6. Annually, each ICD should develop a realistic maintenance and renovation budget for its intra-mural facilities, in addition to congressionally designated funds for maintenance, renovation, and construction.

TABLE 1:
SPACE DISTRIBUTION WITHIN THE
EXISTING CLINICAL CENTER COMPLEX[1]

Program	Net Square Feet[2]
HOSPITAL	
Inpatient Services	205,418
Outpatient Services	71,334
Diagnostic and Treatment	162,065
Support Services	107,633
Administrative Services	52,025
	598,475
RESEARCH	
Laboratory	413,609
Central Research Support	26,112
Vivarium	53,933
Administration - Institute Offices	54,328
	547,982
OTHER SERVICES	
Education Services	60,760
General Support Services	78,360
	139,120
PARKING	537,100

1 These data were developed by the Special Projects Branch of the Division of Engineering Services.

2 Net square feet is the useable floor space within the building. The net square footage is then multiplied by factors to equal the total existing building gross square footage of approximately 3 million square feet.

APPENDIX A:

LIST OF NIH INSTITUTES, CENTERS, AND DIVISIONS

Warren Grant Magnuson Clinical Center (CC)

National Cancer Institute (NCI)

National Institute for Nursing Research (NINR)

National Heart, Lung, and Blood Institute (NHLBI)

National Library of Medicine (NLM)

National Institute for Allergy and Infectious Diseases (NIAID)

National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK)

National Institute of Child Health and Human Development (NICHD)

National Institute on Aging (NIA)

National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS)

National Institute of Dental Research (NIDR)

National Institute of Environmental Health Sciences (NIEHS)

National Institute for General Medical Sciences (NIGMS)

National Institute of Neurological Disorders and Stroke (NINDS)

National Institute on Deafness and Other Communication Disorders (NIDCD)

National Eye Institute (NEI)

National Center for Human Genome Research (NCHGR)

Division of Computer Research and Technology (DCRT)

National Center for Research Resources (NCRR)
National Institute of Mental Health (NIMH)

National Institute on Drug Abuse (NIDA)

National Institute on Alcohol Abuse and Alcoholism (NIAAA)

APPENDIX B:

LIST OF ACRONYMS

AIDS -	acquired immunodeficiency syndrome
ADAMHA -	Alcohol, Drug Abuse, and Mental Health Administration
BSC -	Board of Scientific Counselors
CRADA -	Cooperative Research and Development Agreement
DDIR -	Deputy Director for Intramural Research
DHHS -	Department of Health and Human Services
ERP -	extramural research program
FY -	Fiscal Year
ICD(s) -	Institutes, Centers, and Divisions
IOM -	Institute of Medicine
IRP -	intramural research program
NIH -	National Institutes of Health
PHS -	Public Health Service
SBRS -	Senior Biomedical Research Service
SES -	Senior Executive Service
SSS -	Senior Scientific Service

APPENDIX C:

LIST OF DOCUMENTS REVIEWED BY THE EXTERNAL ADVISORY COMMITTEE

A. BACKGROUND, GENERAL BUDGET, AND POLICY INFORMATION

1. Cohen, J., "Is NIH's Crown Jewel Losing Luster?" *Science* 261, August 27, 1993.
2. DHHS/NIH 1994 Congressional Justification, Summary by Mechanism.
3. Draft Background Report on the NIH Intramural Research Program, prepared by the NIH Internal Fact-Finding Committee on the Intramural Research Program, October 7, 1993.
4. Draft ISI Proposal for Evaluation of NIH Research Using Publication and Citation Data.
5. Historical Overview—Evolution of the National Institutes of Health.
6. History of NIH Intramural Research by Major Category of Expense, October 7, 1993.
7. History of NIH Intramural Research, Major Category of Expense as Percent of Total, October 7, 1993.
8. House of Representatives, U.S. Congress, Departments of Labor, Health and Human Services and Education, and Related Agencies, Appropriations Bill, report language regarding review of the IRP, 1993, 1994.
9. Institute of Medicine, *Report of a Study, A Healthy NIH Intramural Program: Structural Change or Administrative Remedies?* (Washington, DC: National Academy Press, 1988).
10. Intramural Percent Total for Each ICD, October 7, 1993.
11. Intramural Research as Percent of ICD Total for Each ICD, October 15, 1993.
12. Intramural Research, Percent of NIH Total, October 7, 1993.
13. Intramural Research Program, by ICD and Year.
14. Intramural Research Program, Budget Process, October 15, 1993.
15. Intramural Research Program: ICD as Percent of Total NIH IRP, October 7, 1993.
16. Intramural Vs. Total Appropriations for Each ICD, Ranked by Intramural Share, FY 1992, October 7, 1993.
17. Memorandum for Heads of Departments and Agencies from President William J. Clinton, Subject: Streamlining the Bureaucracy, September 11, 1993.
18. National Support for Health R&D by Source, 1983-1993, October 7, 1993.
19. NIH Budget (FY 1992), Table A3, December 1993.
20. NIH Intramural and Total Budget, current dollars, October 7, 1993.
21. NIH Intramural and Total Budget, 1983 dollars, October 7, 1993.
22. NIH Intramural Vs. Total Appropriations, Fiscal Years 1983-1992, October 7, 1993.
23. NIH Response to Institute of Medicine Report, *Strengthening the Scientific Review Procedures of the NIH Intramural Research Program*, Report of a Consultant Panel to the Advisory Committee to the Director, NIH, December 1989.
24. Overview of NIH Budget Formulation Process, prepared by the Division of Financial Management.
25. Recent Changes in the NIH Intramural Research Program, briefing materials provided to the External Advisory Committee, December 1993.
26. Report of the Advisory Committee to the Director, NIH, January, 1990 on *Strengthening the Scientific Review Procedures of the NIH Intramural Research Program.*
27. *Report of the President's Biomedical Research Panel*, submitted to the President and the Congress of the United States (U.S. Department of Health, Education, and Welfare, Public Health Service, DHEW Publication No. (OS) 76-500), April 30, 1976.

28. Report of the Task Force on the Intramural Research Program of the National Institutes of Health (a.k.a. the "Klausner Report"), delivered to Dr. Bernadine Healy, Director, NIH, April 13, 1992.

29. Summary Tables for NIH Zipcode Project, August 18, 1993, Institute for Scientific Information, Philadelphia, Pennsylvania.

B. REVIEW PROCESS FOR TENURED SCIENTISTS AND SCIENTIFIC DIRECTORS

30. BSC Reviews in the Time Period October 1, 1991 to September 30, 1992, Table 1C, November 1993.

31. FY 92 Review of NIH Federal Advisory Committees, revised May 7, 1993.

32. Demographics of Intramural Tenured Investigators, briefing materials, December 1993.

33. Distribution of IRP Personnel by Category, FY 1993, Tables 6 and A6, December 1993.

34. ICD Personnel Data: Fiscal Year 1993, Table 9A, December 1993.

35. Levels of Support for Independent Investigators Who Have Received Negative Reviews, Table 1D, November 1993.

36. NIH response to External Advisory Committee query, "Describe the process or processes currently employed to review the quality of your intramural programs at all levels, from trainees to Scientific Directors, November 1993.

37. Number of Scientific Personnel in Intramural Laboratories, Table 5A, November 1993.

38. Personnel Classification (FY 1992): with FY 1993 Supplement, Table A5, December 1993.

39. Possible Options for Consideration in Reducing NIH Staff, NIH response to External Advisory Committee request for information, February 17, 1994.

40. Report of Board of Scientific Counselors Review, tables listing 1991, 1992, and 1993 meetings of Boards, provided to the External Advisory Committee October 1993.

41. The Intramural Scientific Review Process, position paper submitted by the NIH Internal Fact-Finding Committee on the Intramural Research Program at the request of the External Advisors, December 1993.

C. THE REVIEW PROCESS FOR TENURE

42. Liotta, L.A., *Tenure Track Program of the National Institutes of Health*, National Institutes of Health, 1993.

43. NIH Intramural Research Program Tenure-Track Procedures, Draft, August 9, 1993.

44. NIH Intramural Tenure-Track Policy, Draft, February 19, 1993.

45. Non-Tenure Track Scientists: By Mechanism—FY 1993, Table 9B, ICD Responses, December 15, 1993.

46. Predoctoral and Postdoctoral Fellows and Tenure-Track Scientists (FY 1993), ICD Responses, December 1993.

47. Recruitment for Tenure (Independent Research Investigators), Table 1A, November 1993.

48. Sample NIH Tenure Track Agreement, Draft, 1993.

49. Tenured and Tenure Track Scientists, Table 1B, November 1993.

50. "The Review Process for Tenure," position paper submitted by the NIH Internal Fact-Finding Committee on the Intramural Research Program at the request of the External Advisors, December 1993.

D. TRAINING

51. "Graduate Student Programs," position paper submitted by the NIH Internal Fact-Finding Committee on the Intramural Research Program at the request of the External Advisors, December 1993.

52. Intramural Postdoctoral Training Programs, December 1993.

53. Pharmacology Research Associate Program, December 1993.

54. Post-Docs: 1988 and 1992 (from Table 1B: November 10, 1993) revised and distributed February 25, 1994.

55. Predoctoral and Postdoctoral Fellows and Tenure-Track Scientists (FY 1993), Table 8, December 1993.

56. "Role of Postdoctoral Fellows in the Intramural Program", position paper submitted by the NIH Internal Fact-Finding Committee on the Intramural Research Program at the request of the External Advisors, December 1993.

57. Trainees: By Mechanism, FY 1993, Table 9C, December 15, 1993.

E. ORGANIZATIONAL ISSUES AFFECTING RECRUITMENT AND RETENTION

58. "Mechanisms for Enhancing the Attractiveness of the NIH Intramural Research Program for Senior Scientists," position paper submitted by the NIH Internal Fact-Finding Committee on the Intramural Research Program at the request of the External Advisors, December 1993.

59. NIH Response to External Advisory Committee query, "Describe briefly, from your ICDs' perspective, the organizational issues that are disincentives to the support of the highest-quality research and training in the intramural programs," November 1993.

60. "Organizational Issues Which Are Disincentives to the Support of the Highest Quality Research and Training in the Intramural Program," position paper submitted by the NIH Internal Fact-Finding Committee on the Intramural Research Program at the request of the External Advisors, December 1993.

F. NIH-PRIVATE SECTOR COLLABORATIONS

61. Assistant Secretary for Health Memorandum to Acting Inspector General, OS, Subject: Office of Inspector General Draft Report "Technology Transfer and the Public Interest: Cooperative Research and Development Agreements at the National Institutes of Health," OEI-01-92-01100, October 8, 1993.

62. Clinical Center Protocols Turned Over to the Private Sector for Development and Evaluation, Table 3C, December 1993.

63. CRADA Activity—All ICDs Combined, Table 7, December 15, 1993.

64. CRADA Activity, by ICD, Table 7, December 1993.

65. Department of Health and Human Services, Office of Inspector General, Technology Transfer and the Public Interest: Cooperative Research and Development Agreements at NIH, November 1993.

66. History of CRADA and Conditional Gift Funds: NonFederal Support, Bar Graph 7, November 1993.

67. NIH Actions in Response to the Report on PHS CRADAs, December 15, 1993.

68. NIH CRADA Guidelines, draft, November 9, 1993.

69. "NIH-Private Sector Collaborations," position paper submitted by the NIH Internal Fact-Finding Committee on the Intramural Research Program at the request of the External Advisors, December 1993.

70. Outside Activities of IRP Scientists, 1993, Table 2, ICD Responses, December 1993.

71. Phase III and Phase IV Clinical Trials, Table 4, December 1993.

G. PROCESS FOR ALLOCATING FUNDS BETWEEN THE EXTRAMURAL AND INTRAMURAL PROGRAMS

72. Balance Between IRP/ERP, Tables 2A-2D, November 1993.

73. NIH Response to External Advisory Committee query, "Describe the process by which the size of the (1) scientific, (2) administrative, and (3) training components of your intramural programs are determined. (How are decisions made regarding allocation of resources and the balance between IRP and ERP)," November 1993.

74. "Process for Allocating Funds Between the Extramural and Intramural Programs," position paper submitted by the NIH Internal Fact-Finding Committee on the Intramural Research Program at the request of the External Advisors, December 1993.

H. RENEWAL OF THE CLINICAL CENTER

75. Amount of Space Allocated to Intramural Laboratories (FY 1993), Table 5C, November 10, 19993.

76. Annual Inpatient Admissions, NIH Clinical Center, October 7, 1993.

77. Average Cost for Intramural Scientists (FY 1992), Table A1, December 1993.

78. Average Inpatient Occupancy by Institute and Day-Of-Week, Fiscal Year 1993, December 1993.

79. Average Length of Stay, NIH Clinical Center, Total Admissions, Less NIMH, NIAA, October 7, 1993.

80. Average Length of Stay, NIH Clinical Center, NIMH, NIAA, and All Other, October 7, 1993.

81. Buildings and Facilities, Appropriation History (Dollars in Thousands) 1975 to 1984, and 1985 to 1994, April 7, 1993.

82. Clinical Center Bed Occupancy: February 16, June 15, October 29, 1994, Table 5, December 1993

83. Clinical Center Complex, Clinical Research Program Handouts, Renewal Options, Project Briefing, December 10, 1993.

84. Clinical Center Renovation/Construction Options, NIH response to External Advisory Committee request for information, January 11, 1994.

85. Clinical Center Summary Data, October 7, 1993.

86. Clinical Research Costs (Dollars in thousands), Table 3C, November 1993.

87. Clinical Research Program, briefing materials presented to the External Advisory Committee, December 1993.

88. Clinical Protocol Rankings, December 1993.

89. Clinical Trials (dollars in thousands), DHHS/NIH, April 20, 1993.

90. Clinical Trials, Narrative Examples, November 10, 1993.

91. Costs for Developed Options I, II, and III, January 1994.

92. Current beds/staffing at the Clinical Center, NIH response to External Advisory Committee request for information, January 14, 1994.

93. Data on National Hospital Construction Projects, collected by NIH Special Projects Branch, February 17, 1994.

94. Drug Discovery and Transfer, 1988-1993, Table 1, December 1993.

95. FY 1994 Unit Costs for Hospitals and Laboratories adjusted to the Washington D.C. area, January 1994.

96. FY 1993 Contracts in Support of Clinical and Laboratory Research, NIH response to External Advisory Committee request for information, January 14, 1994.

97. Graphs of Clinical Center Inpatient Activity, memorandum from Management Analyst, EO, CC, to Edward J. Lynch, OSPL-OD, December 22, 1993, includes "NIH Clinical Center Average Occupancy by Institute FY 1993," and "NIH Clinical Center Inpatient Beds Occupancy FY 1993."

98. Hospital Statistics—1989 Data, October 7, 1993.

99. ICD Response to External Advisory Committee query "Provide the rationale for having your patient-oriented clinical research protocols in the intramural programs instead of the extramural," November 1993.

100. Innovative Projects Without Guarantee of Success, NIH response to External Advisory Committee request for information, December 1993.

101. Inpatient Bed Occupancy by Day-of-Week, December 1993.

102. Intramural Clinical Trials, Table 3A, November 10, 1993.

103. Institute responses related to the justification for the use of the Clinical Center, January 11, 1994.

104. IRP Net Usable Space: Total and Per Person (FY 1992), Table A2, December 1993.

105. Memorandum dated October 18, 1993, from Acting Director, Clinical Center to Scientific Directors of ICDs with Intramural Clinical Programs, regarding Response to FTE Cuts in CC FY 1994 Budget: Proposals for Consolidating Patient Care Units.

106. National Institutes of Health, Clinical Center Complex, Bethesda, Maryland, Program Justification Document, Office of Research Services, Division of Engineering Services, February 1993.

107. NIH Clinical Center Institutes Assessments, 1982-1992, Current Dollars, October 14, 1993.

108. NIH Expenditures for Renovation, Construction and Maintenance, February 22, 1994.

109. NIH Intramural Contracts FY 1993: Support for Clinical and Laboratory Research, December 1993.

110. NIH Intramural Contracts FY 1993: Operational Support for Off-Campus Clinical and Laboratory Research, December 1993.

111. NIH Intramural Research Costs Vs. Clinical Center Assessments, October 7, 1993.

112. Net Usable Space, (net square feet) Total of On- and Off-Campus, Table 2B, December 1993.

113. Need for Proximity Between Laboratories and Clinical Facilities, Table 6, December 1993.

114. Outpatient Clinic Visits, NIH Clinical Center, October 7, 1993.

115. Presentation to External Advisors NIH Intramural Research Program Review, October 15, 1993, by the Office of Research Services, Division of Engineering Services.

116. Professional Planning Guidelines for a Proposed 300 Bed Hospital, NIH response to External Advisory Committee request for information, February 17, 1994.

117. Proposed Patient Care Unit Consolidations, Attachment 1, Revised 10/18/93.

118. Ranking of Clinical Center Research Protocols for 1993, ICD Responses - December 1993.

119. "Renewal of the Clinical Center (options)," position paper submitted by the NIH Internal Fact-Finding Committee on the Intramural Research Program at the request of the External Advisors, December 1993.

120. Research Beds Off NIH Campus, December 1993.

121. Selected Clinical Center Inpatient Data, October 7, 1993.

122. Services and Supply Budgets of Intramural Laboratories (FY 1993), Table 5B, November 1993.

123. Status of Clinical Center Protocols: 1988-1993, Table 3B, December 1993.

124. Total Budgets for Laboratories or Branches (FY88-FY92), Table 8, November 1993.

APPENDIX D:

MEETING DATES OF THE EXTERNAL ADVISORY COMMITTEE

October 15, 1993

November 12 and 13, 1993

December 10, 1993

January 27 and 28, 1994

February 25, 1994

Implementation Plan and Progress Report External Advisors' Report on the NIH Intramural Programs

November 17, 1994

IMPLEMENTATION PLAN AND PROGRESS REPORT EXTERNAL ADVISORS' REPORT ON THE NIH INTRAMURAL PROGRAMS

Introduction

In response to a Congressional request to review the "role, size, and cost" of the NIH Intramural Research Programs, an External Advisory Committee (EAC) was constituted as a subcommittee to the Advisory Committee to the Director, NIH. Chaired by Dr. Paul Marks, (Memorial Sloan-Kettering Research Foundation) and Dr. Gail Cassell (University of Alabama School of Medicine), the EAC submitted a report to the NIH Director on April 11, 1994. This report included recommendations concerning seven different aspects of scientific research at the NIH: (1) the review process for tenured scientists and Scientific Directors; (2) the review process for tenure; (3) postdoctoral training; (4) organizational issues affecting recruitment and retention; (5) NIH-private sector collaborations; (6) the process for allocating funds between extramural and intramural programs; and (7) the renewal of the Clinical Center. There are eleven major recommendations stated in the Executive Summary of this report, and the individual subsections enumerate a total of 42 specific recommendations, many of which provide a detailed prescription for altering or strengthening the process by which intramural research is currently conducted.

The goal of the report of the EAC is to re-invigorate a distinguished scientific institution by improving the uniformity and rigor of its scientific review and recruitment processes, reducing administrative impediments to research so as to aid in recruitment and retention of the most capable and diverse scientific staff, and revitalizing the Clinical Center, which is a unique feature of the Intramural Research Programs through which basic science is translated into new and improved diagnosis, treatment and prevention of disease as well as improved patient care.

Eight months after the submission of this external review, we are pleased to provide a detailed accounting of the changes in the Intramural Program that have occurred, and to offer a synopsis of progress in those areas in which changes are anticipated, but have not yet been accomplished. All of the 42 recommendations made in the report have been discussed by the NIH Director and the Deputy Director for Intramural Research (DDIR) with the Scientific Directors and the Internal Working Group on the Intramural Program. Comments from the NIH scientific staff have been viewed, and several of the proposed changes have been acted on by the Directors of Institutes, Centers and Divisions (ICDs) at the NIH. The process of revitalization of the Intramural Programs envisioned by the External Advisors' Report has begun in this collegial spirit, and we believe the result, as detailed in this implementation plan, is a thoughtful re-evaluation and substantial re-working of many of the processes by which science is reviewed and administered in the intramural programs.

The format of this "Implementation Plan and Progress Report" is modeled after that of the EAC Report. An introduction to each section that summarizes the major changes that have occurred in response to the EAC Report is included, followed by a point-by-point discussion of the individual recommendations within each section keyed to the recommendation numbers in the original EAC Report.

(1) Review Process for Tenured Scientists and Scientific Directors

The review process by which intramural science is reviewed has been altered to respond to concerns expressed in the EAC report. A Manual Chapter on "Review and Evaluation of Intramural Programs" has been revised significantly following a series of meetings by the Deputy Director for Intramural Research with chairs of the Boards of Scientific Counsellors (BSCs), and the Scientific Directors. The DDIR has met with most of the chairs of the BSCs to emphasize the importance of independent, rigorous, and explicit reviews to aid the Scientific Directors in distributing resources within each intramural program.

Recommendation #1 (Meeting of BSC Chairs): The then Acting DDIR met with the chairs or their representatives of all of the Boards of Scientific Counsellors (BSCs) on August 1, 1994. A list of the attendees at this meeting is included in Appendix I. The current Federal Government requirement that standing advisory committees be reduced constrains the establishment of a standing "External Advisory Committee to the Intramural Research Program," as suggested by the External Advisors. However, the BSC chairs will meet annually as informal consultants to the DDIR as proposed in the EAC

Report, to describe the state of each intramural program, and to discuss strengths and weaknesses in each review process. The next meeting of the BSC chairs is scheduled for January 19, 1995.

Recommendations #2 and #3 (BSC membership and review process): The first meeting with BSC chairs resulted in a detailed list of proposed changes in the review process used by the BSCs, the intent of which was to make more rigorous and uniform the intramural review process. These recommendations have been discussed with the NIH Director, the Scientific Directors, and the ICD Directors, and reformulated as a revised "Manual Chapter." This Chapter spells out specific guidelines for the selection of BSC members, selection of BSC chairs, the nature of the review process to be used by BSCs, and the review of the Scientific Director. This Manual Chapter, included as Appendix II, will be provided to every incoming BSC member, and will be summarized in revised Orientation Guidelines to be provided to each BSC member and to ad hoc members of site visit teams that review intramural programs.

The new Manual Chapter strongly enforces the major goals of the recommendations made in the EAC Report to increase the independence, rigor, and uniformity of the review process, and to emphasize the primarily retrospective nature of the review of intramural research and its critically important advisory function to the Scientific Directors. This has been done by: (1) specifying that new BSC members and chairs are recommended by the ICD Directors with the approval of the NIH Director and the DDIR; (2) requiring that all written reviews of the BSCs include explicit recommendations for resource allocation; (3) establishing a new proceedure for periodic review of Scientific Directors consisting of an *ad hoc* external committee chosen by the ICD Director in consultation with the NIH Director and the DDIR; and (4) emphasizing that the process by which intramural research is reviewed is different from the process used extramurally in that it is primarily (albeit not exclusively) retrospective.

The detailed recommendations made in the EAC Report about how to achieve the goals outlined above differ somewhat from the final recommendations made in the Manual Chapter. In some cases these differences represent limitations inherent in the way the Federal Government conducts its affairs; in others they represent legitimate differences of opinion about how best to achieve the goals of the EAC Report. Specific differences between the requirements of the revised Manual Chapter and the EAC Report are as follows: (1) BSC members and chairs are not to be chosen by a vote of the current BSC, since government policy on standing committees requires that a government official appoint advisory committee members, and there was concern that allowing the current BSCs to choose their own membership might delay implementation of changes in the review process ; (2) The review of the Scientific Director will be by an independent ad hoc committee, established by the ICD Director, rather than by the BSC itself. Since the BSC is advisory to the Scientific Director on matters of science, it is not an appropriate body to review the administrative prowess or leadership capability of the Scientific Director, which is best done by an independent committee constituted for this purpose. Furthermore, the relationship of the BSC and the Scientific Director changes substantially if the committee which is giving advice can influence the Scientific Director in any way to respond to that advice, making the BSC the de facto director of intramural research; (3) Tenure-track scientists will be reviewed as close as possible to the middle of their 6-year tenure track period on the same cycle as their laboratory (reviewed every 4 years); (4) Terms of BSC membership will remain at 5 years, since this allows at least some BSC members to see each laboratory twice in the 4-year review cycle. (The BSC chairs were adamant that they should not be subject to "double jeopardy" regarding service on other NIH panels and advisory committees. Although not explicitly stated in the Manual Chapter, a two-term limitation would be generally enforced by the ICD Directors, the DDIR, and the NIH Director); and (5) The possible limitation of the length of background material and the retrospective vs. prospective balance of the scientific presentations has been a subject of considerable debate. The revised Manual Chapter *suggests* limits on the length of the report (3-5 pages), and emphasizes the retrospective nature of the review, but indicates that some part of the presentation should deal with future plans (1-2 pages). This represents a compromise reflecting the diverse opinions expressed by the BSC chairs, the Scientific Directors, the EAC Report, and the DDIR, and, it is believed that it should not have negative impact on the rigor of the review process.

(2) Review Process for Tenure

In keeping with evolutionary changes which have been occurring in the Intramural Research Program over the past several years, and incorporating suggestions from the EAC Report, a completely new Tenure Program has been developed at the NIH. A description is presented in Appendix III. Highlights of the program include a requirement for national searches for all tenure-track positions, formal agreements by ICDs with all tenure-track scientists which spell out independent resources for personnel, budget and space, a 6 year tenure-track with mid-period review which includes stop-the-clock provisions for any scientist who wishes to take time off for personal reasons, and a new NIH Central Tenure Committee consisting of 15 senior NIH scientists, advisory to the

DDIR, which replaces the Board of Scientific Directors in making final recommendations on all tenure decisions (Appendix IV).

This new Tenure Program has been approved by the Board of Scientific Directors, the ICD Directors, and the Director, NIH. Final approval by the Public Health Service is needed to allow for the extension of the appointments of some staff so that they can be enrolled or continued in the tenure-track.

Recommendations #1- #4 (Establishment of a new Tenure Program): The Tenure Program that has been established is identical in virtually all respects to the program recommended by the External Advisors, except that the Central Tenure Committee will not be responsible for approval of tenure-track candidates. These decisions will be made by the Scientific Director and ICD Director, with concurrence of the DDIR. However, to assure that the process by which searches are conducted to identify the best possible candidates for tenure-track positions is fair and rigorous, the search committee must have a chair who is an expert in the scientific area but is not the Laboratory or Branch Chief in the Laboratory or Branch in which the position has been created, representation by women and minority scientists, an ex officio member from the ICD's EEO office, and a representative chosen by the DDIR from recommendations made by the major scientific special interest groups. The final composition of this committee, and the candidate chosen by the ICD must be approved by the DDIR. As needed, the DDIR will seek the advice of representatives of the NIH Central Tenure Committee, or other expert advisors.

(3) Postdoctoral Training

The EAC Report points out that the NIH IRP is the single largest postdoctoral biomedical training institution in the U.S., but few resources have been committed to develop a coordinated program to recruit, mentor, and track NIH post-doctoral fellows for quality and diversity. While an Office of Education has been in existence within the Intramural Program, such training programs will be enhanced by the formation of a new Office of Science Education which will utilize existing resources more efficiently to oversee all intramural and extramural educational activities, and will aid in the coordination of these activities. This new office will be in the immediate Office of the NIH Director and will consist of three major activities: (1) Extramural and outreach; (2) Intramural training ; and (3) Loan repayment and scholarship. The activities related to Intramural Training and Loan Repayment and Scholarship are described below. An Advisory Committee, chaired by the DDIR, will oversee educational projects in the new Office of Science Education.

In addition to the establishment of the Office of Science Education, a new focus will be created in the Intramural Program for training and mentoring of postdoctoral fellows. Thus, education of postdoctoral fellows will take its place beside biomedical research activities as a major goal of the intramural program. The implementation of this new post-doctoral training program, facilitated by the suggestions contained within the EAC Report, will have many components which are outlined below:

Recommendation #1 (Training Faculty): Efforts described elsewhere in this document detail the initiatives designed to revitalize and maintain the quality of the intramural program.

Recommendation #2 (Recruitment): Because the intramural program trains nearly 15% of the nation's postdoctoral fellows in the biomedical sciences, it bears a special responsibility to ensure that it recruits from a diverse, well-qualified applicant pool and identifies the most outstanding postdoctoral candidates. Initiatives to do this are summarized below and include a broad-based advertising effort, targeted recruitment to ensure that the appropriate candidates are reached, and a program of incentives for potential trainees.

(1) *Implementation of a broad-based advertising campaign.* As part of a recent effort, advertising for clinical and postdoctoral positions has been centralized in the Office of Science Education. Potential candidates are now informed of positions across all of the institutes in the intramural program through full page advertisements in *Science, Cell,* the *New England Journal of Medicine* and other appropriate journals. To further facilitate a prospective trainee's exploration of intramural opportunities, a catalog summarizing NIH intramural training opportunities has been made available over the Internet. Instructions for accessing these additional resources are carried in each advertisement. Initiatives for direct mailings and for exhibits at scientific meetings round out the advertising campaign. Direct mail is used to reach all potential clinical trainees in the nation, who, by nature of their training, may be candidates for NIH subspecialty and research training programs. The lack of similar databases for graduate students and postdoctoral fellows limits the efficacy of this technique for reaching prospective postdoctoral Ph.D. fellows. However, direct mailing is now being used for targeted recruitment as described below. In addition, recent efforts to exhibit intramural opportunities at scientific meetings is proving to be a useful way to contact graduate students and postdoctoral fellows who may wish to consider intramural training opportunities.

(2) *Targeted recruitment.* Targeted recruitment efforts have been implemented to ensure that the applicant pool is diverse and well-qualified. This has involved two

separate initiatives that overlap in the populations they reach. One initiative targets populations who have been traditionally underrepresented in the sciences. A second targets prospective candidates who, by the nature of their previous research experience or training, are considered to be highly competitive candidates for intramural training. Since the initiatives are quite similar in the methods employed, they will be discussed together here. Direct mailing is a major component of targeted recruitment. Descriptions of NIH intramural training opportunities have been mailed to MD/PhD students, former Howard Hughes Medical Institute Research Scholars, MARC scholars and predoctoral students and minority students supported on NIH research grant supplements and on National Research Service Award (NRSA) predoctoral training grants. Plans are being developed to expand, as much as possible, the direct mailing effort to include the extramural population of students supported by the NRSA program, by National Science Foundation predoctoral fellowships, and fellowships from the Howard Hughes Medical Institute. The direct mailing program is supplemented by advertising in the special sections in *Science* devoted to minority scientists and to women scientists as well as in journals targeting minority scientists and physicians. In addition, exhibits on intramural opportunities are now shown at meetings targeting minority scientists, e.g., the National Institute of General Medical Sciences Minority Programs Symposium, the Research Centers in Minority Institutions International AIDS Symposium, and the National Science Foundation Diversity Conference.

(3) *Incentives for Trainees.* The intramural program strongly agrees that incentives are needed to attract talented individuals into biomedical research training programs. In its recommendations the Committee suggested that two programs be established—(a) a program for repayment of educational loans analogous to that offered by the National Health Service Corps and (b) a Distinguished Scholars Program.

(a) Loan Repayment. Such efforts have been vigorously pursued by the NIH for a number of years. Since 1989 the NIH has had a program providing repayment of educational debt for individuals entering the intramural program to engage in AIDS-related research. This authority was extended in The National Institutes of Health Revitalization Act of 1993, Public Law 103-43, and provides authorization for two additional loan repayment programs and a scholarship program specifically relevant to the intramural program. The Director of NIH has recently implemented one of the loan repayment programs to provide repayment of educational debt for clinicians from disadvantaged backgrounds, including minorities, who are entering clinical research training or performing clinical research within the intramural program. In a second program slated for implementation within the next two years, the repayment of educational debt would be extended to cover biomedical research generally. In addition, the NIH has received authorization for an undergraduate scholarship program for persons from disadvantaged backgrounds—an effort that is expected to encourage minorities and others to pursue intramural training and careers in the biomedical sciences.

(b) Distinguished Scholars Program. There is great interest in establishing a program to recruit the highest quality scientific personnel. There are two possible approaches to this goal, both of which are being pursued. In the first,under contract, the National Research Council of the National Academy of Sciences will do outside review of applicants for a senior post-doctoral training program. This program has been in existence at the NIH for several years, but it has now been expanded and more clearly defined as highly selective. The second approach involves extension of NIH training authority to the Office of the Director and has been requested from Congress.

Recommendation #3 (Selection of postdoctoral fellows): As detailed in the response to Recommendation #2, a broad-based advertising and direct mailing campaign is underway. At present the applications for a postdoctoral position, specifically the Intramural Research Training Award, which require inclusion of history of educational experience, publications, research presentations, etc. are used by intramural faculty to identify and ultimately select the highest quality candidates available.

Recommendation #4 (Independence and career development of fellows): The EAC has rightly emphasized the importance of career development and independence for trainees. The intramural program is currently developing an overall approach to mentorship and career development for its trainees. Although the plan is under development, it will likely include the following features, portions of which are in the process of implementation.

(1) *Graduated independence.* The commitment to providing graduated increases in responsibility and independence is a critical element in the revitalization of intramural training. In keeping with that commitment, postdoctoral fellows now entering intramural training will be expected, in general, to remain for only 2 to 4 years, but not to exceed 5 years, and then seek other positions offering increased independence.

(2) *Centralization of training information on all intramural fellows.* A centralized database will be designed to provide the intramural program with the capability of monitoring the quality of incoming trainees, monitoring the

quality of the intramural experience, contacting trainees directly about training issues, and initiating the process of tracking the careers of fellows who have completed intramural training.

(3) *Guidelines for one-on-one mentorship.* Incoming postdoctoral fellows in each of the ICDs receive training in issues related to the conduct of science and a copy of NIH "Guidelines on the Conduct of Science". Additional guidelines on the roles and responsibilities of fellow and mentor will be developed as part of an expanded discussion among the faculty, fellows, and administration about intramural training. The consensus document will be circulated to current and incoming fellows and all tenured intramural faculty to bring clarity and uniformity to expectations and responsibilities for participants in the training process. It is anticipated that the document will continue to evolve just as the training relationship will. The Women Scientist Advisors and the Working Group on Under-represented Minority Scientists have also begun to develop mentorship programs.

(4) *Opportunities for institutional mentorship.* Institutional mentorship subsumes those efforts and programs that can be provided to facilitate the fellows' transition into postdoctoral training, optimizes their training experience, and facilitates the successful transition to an independent career.

(a) Facilitating the transition into postdoctoral training. An NIH Postdoctoral Fellows Handbook is being developed to provide every incoming fellow with basic information about the training experience, the institution, and quality of life issues. The handbook, developed in consultation with the NIH Fellows Committee, will cover over 70 topics including such items as educational opportunities on the intramural campus, expectations for postdoctoral training, commonly asked questions about benefits and insurance and day care information.

(b) Optimizing the Training Experience. To optimize the training experience, new programs have recently been offered to meet needs identified by fellows. Two examples include an Introduction to Molecular Biology for Postdoctoral Fellows and A Short Course and an Introduction to the Computer Resources on the NIH Campus. Under development by the Clinical Center is an introductory course in clinical research. This course, designed to prepare fellows for careers in clinical research, will provide instruction in such topics as experimental design, biostatistics, grants, ethics and human subject research considerations, the infrastructure required for clinical research, clinical studies and regulatory agencies including the FDA, quality assurance in large scale trials, gender and racial diversity in study populations, legal issues, and technology transfer considerations.

(c) Facilitating the transition to an independent career. Programs addressing the transition to an independent career have been offered recently and include: *Funding and Collaborative Research Opportunities in the Private Sector, a Workshop; Pursuing a Career in Academia*—a Workshop; *Postdoctoral Fellows Forums on Tenure Issues;* and *Biomedical Science as Viewed by the American Public through the Eyes of the Media.* Future programs are expected to include such topics as managing personnel, resources, and science in a research laboratory; the role of the scientist in making science policy; the role of scientific societies in the research enterprise; and the need for broader training of fellows in preparation for careers outside of academia.

(5) *Opportunities for networking, visibility, and exposure.* As part of the process of revitalizing the intramural campus and providing new opportunities for fellows, special interest groups of scientists in a wide variety of biomedical disciplines have been organized on campus. These organizations offer opportunities for fellows to interact with scientists across the intramural program. Additionally, nearly every week throughout the academic year, the special interest groups will host internationally recognized scientists from outside the NIH who will deliver a seminar and be available for meeting with interested scientists and fellows. Poster sessions are also planned following the seminars which will offer fellows an opportunity to present their work. The NIH Fellows Committee have chosen and are hosting three of this year's speakers. In addition, the Scientific Directors have agreed to support an annual symposium organized by the Fellows Committee.

(6) *Opportunities for recognition.* Recognition by one's scientific peers has value in advancing the careers of students and fellows and in providing encouragement to achieve excellence in research. The Scientific Directors, through their intramural travel funds, have agreed to support an award program based on abstracts submitted. Under consideration is the creation of a database of awards, fellowships, and other sources of recognition for which fellows could apply.

(7) *Expansion of opportunities for input from fellows.* The NIH Fellows Committee, recently established, has afforded the community of fellows an avenue to work with the NIH administration on issues of training, education, and the quality of life for fellows within the intramural program. An electronic bulletin board has been developed to foster discussions among fellows, faculty, and the administration. This complements the invitations from the NIH leadership to fellows welcoming suggestions by e-mail or fax.

(8) *Opportunities for employment.* In its infancy is a new database developed by the Office of Education for fellows completing intramural training. The database lists employment opportunities in academia and the private sector. It also provides pointers to other extant databases listing academic positions. The service is provided free to all advertisers. As another service to fellows, the NIH will participate in an electronic system that transmits the resumes of fellows seeking employment to interested parties in the private sector and academia.

(9) *Under-represented Groups.* Women, minorities, and disabled scientists in training in the intramural program have articulated needs critical to the development of a diverse scientific workforce. Recommendations from women scientists and fellows have led to the establishment of Women Scientist Advisors who report to the Scientific Director in each ICD. One of the first achievements of this group has been the development of evidence related to pay discrepancies between men and women scientists in many of the intramural programs. The advisors also provide information, guidance, and a source of contacts for fellows who are women. How to address the differing needs of minority fellows is currently under exploration by a Working Group of Under-represented Minority Scientists impaneled by the DDIR. One of the recommendations is to provide a special programs officer within the Office of Science Education to act as a focal point for issues affecting the recruitment, training, and advancement of all fellows with particular emphasis on those underrepresented in the sciences. As part of this process, a network of advisors and mentors may be established for fellows who need career guidance in addition to that offered by their scientific preceptors.

(10) *Evaluation.* Evaluation of program quality is an essential part of any mentorship and career development program. Development of an assessment program for the intramural program is in the planning stages and is described in more detail in the response to Recommendation #6 (see below).

Recommendation #5 (Diversity): A series of initiatives has been implemented to increase racial and ethnic diversity among trainees.

(1) *Closer coordination between the intramural program and NIH programs supporting minority students is underway.* As part of that effort the intramural program is contacting students in the MARC program (undergraduates and predoctoral students), NRSA predoctoral minority fellows, and students supported by minority supplements to NIH grants to inform them about the NIH intramural training opportunities. In addition, internship positions are being used across the intramural campus to bring MARC scholars to the intramural program during the summer so that they may better understand the opportunities for intramural training in the future and receive encouragement to continue their pursuits of research careers.

(2) *The Intramural Training Awards Program* has been expanded recently to offer research training positions for medical students and recent recipients of the baccalaureate degree. This program is seen as a new tool that can be used to target underrepresented minorities and provide them with an experience that may encourage them to consider intramural training and ultimately careers in research. The research positions extend for 1-2 years prior to graduate or medical school. In addition, a stay-in-school IRTA program has been established for full-time students in high school and college who are economically disadvantaged . This program provides stipends for students to work as laboratory trainees half-time throughout the school year and full-time during the summer months.

(3) *The Loan Repayment Program for Clinical Researchers from Disadvantaged Backgrounds* and the soon to be implemented scholarship program for undergraduates from disadvantaged backgrounds are seen as attractive incentives to provide ethnic diversity within the intramural training program. These programs are described in the response to Recommendation #2.

Recommendation #6 (Assessment): The intramural program is in agreement with the need to assess the quality of the training it provides. Currently in the planning stage is an evaluation that will have the following components:

(1) *Assessment of the quality of incoming intramural trainees.* A centralized database of all intramural trainees will be established, including degrees, educational institutions attended, grades, prior research experience, site and type of prior clinical training, publications, awards, etc. This information will be used to monitor the quality of incoming clinical and postdoctoral trainees.

(2) *Assessment of the quality of the intramural training experience.* Plans are being developed to evaluate the intramural experience using indicators that will be collected during the period of training as well as regularly after the completion of training.

(a) Evaluation during the period of intramural training. Under consideration is an evaluation program that would be modeled after the evaluation efforts established for clinical trainees in accredited residency and subspecialty programs. Such analysis would include evaluation of the training program by both the trainees and the preceptors, evaluation of the trainee by preceptor

and of the preceptor by the trainee. Additional measures of performance may include publications, abstracts, scientific presentations, awards, meetings attended, courses taken, etc. An exit questionnaire, to be completed anonymously and a separate form inquiring about any position accepted after training, as well as information providing forwarding address(es) to be used for tracking purposes would be given to each fellow approaching the completion of training. Completion of these forms would be encouraged as part of the separation process. A questionnaire has been designed for this purpose and is being tested at present.

(b) Evaluation following intramural training. Planning is underway to establish a tracking system to follow the progression of the careers of intramural trainees with the aim of using these data to improve the efficacy of intramural training. Several options are under consideration: (1) A system similar to that required for trainees supported on NIH NRSA training grants is under consideration; however, the means to follow such trainees is limited to those who may also appear in other databases including the Contracts & Grants Award File at NIH, the AAMC Faculty Roster System, the Doctorate Recipients File, and the Survey of Doctorate Recipients. Alternatively, under consideration is a more detailed tracking system that would follow trainees for a decade upon completion of training. Former trainees would be contacted, perhaps on a biennial basis, to provide an update on the status of their careers. The initial follow-up at two years may well include an evaluation of the value of their training experience given the perspective of the first two years of employment. Since such a tracking program may prove to be a model for other institutions, the planning may also include input from the NRC, the AAMC, academia, extramural and intramural NIH, NSF and others.

(4) Organizational Issues Affecting Recruitment and Retention

The need to "reinvent government" to make it more attractive to outstanding junior and senior scientists is felt keenly by the current NIH leadership. The intramural program has initiated a major effort to identify those aspects of the operation of the NIH which would benefit from streamlining and re-engineering. A working group on "intramural re-invention", chaired by the Deputy Director for Intramural Research and the Executive Officer of NHLBI, has made a large number of recommendations for changes which can be implemented either at the NIH, at the level of the Department of Health and Human Services, or as a result of legislative change. The major principles underlying these recommendations are: (1) authority should be delegated down to the level at which informed decisions can be made so as to give Laboratory and Section Chiefs the authority for many routine personnel and procurement decisions; (2) that personnel and procurement systems should be re-engineered to be responsive to the special needs of scientific and technical work; and (3) that legal requirements for accountability can be built in without the need for bureaucratic layering. A summary of these recommendations is attached as Appendix V of this document. Since approval of most of these recommendations must await evaluation by the Department of Health and Human Services, and implementation may require far-reaching legislative changes in some cases, stop-gap measures are being designed.

Recommendation #1 (IRPs as an administrative expense): We agree that the designation of the intramural research program as an NIH administrative expense is a major impediment to efficient recruitment and promotion of talented intramural scientists, since it makes the IRP subject to FTE limitations irrespective of budget limitations, and prevents promotion of scientists to levels of GS-14 or above (comparable to Associate Professor in academic terms). Efforts to reverse this decision have so far been unsuccessful.

Recommendation #2 (Review of regulations that limit recruitment and retention): As noted above, a working group on intramural re-invention has been established, and has completed a set of far-reaching recommendations for re-invigorating the administration of the intramural program. These are outlined in Appendix V.

Recommendtions #3 and #4 (Senior Biomedical Research Service): A Senior Biomedical Research Service (SBRS) established for recruitment purposes as well as career development of senior scientists, passed by Congress in 1990, has received support of the Department of Health and Human Services, and the Office of Management and Budget has endorsed implementation while the process of rule-making is underway. A credentialling committee consisting of ICD Directors, Scientific Directors, and senior intramural scientists has been assembled by the NIH to identify candidates for the SBRS in the following priority order: (1) new recruitments; (2) retention of outstanding scientists; and (3) promotions for exceptional intramural scientists. The SBRS also includes a portable retirement system compatible with academic TIAA-CREF retirement systems. The NIH leadership is also discussing with the Veteran's Administration, the Bureau of Prisons and the Department of Defense, an extension of Title 38 authority to supplement salaries of clinical care physicians working in the Clinical Center. In order to have SBRS and Title 38 be optimally useful, authority to hire and promote at the GS-14 or above level is needed.

Recommendation #5 (Procurement, space, and personnel): The Office of Management and Budget (OMB) has backed, in principle, efforts throughout the government to improve the current procurement system as recommended by the National Performance Review. Appendix V summarizes changes in procurement that would improve the efficiency of conduct of intramural research.

To make space available for new recruitments, a subcommittee of Scientific Directors recently suggested several ways to create a NIH Director's Space Reserve. New laboratory space is expected to be available in the next 5-6 years, in association with completion of the new hospital and a new research building (building 50, which replaces buildings 2,3 and 7). In addition, space can be generated on campus by exchanging non-wet lab space (such as offices and computer facilities) in laboratory buildings for office space both on and off-campus to allow renovation of existing on-campus office space as laboratory space. Improvements in the speed with which renovations can be done will depend on acceleration of the current procurement system. Such improvements have been requested. A Master Plan for campus space is under development by the Office of Research Services, the Office of Intramural Research, and the Office of the Director, NIH, in consultation with NIH scientists and members of the local community. This plan will maintain the current size of the research force, and gradually increase research space over the next 10 years to reduce crowded conditions in the laboratories.

There will be a new emphasis on shared facilities, both within the NIH, and between intramural and extramural NIH. This was a major subject of discussion at an "NIH Leadership Forum" attended by the ICD Directors and Scientific Directors at Airlie House, Virginia, on August 30, 1994. Documentation of existing shared facilities and ideas for new sharing of facilities are being developed.

In addition to sharing facilities, a much greater effort is underway to share intellectual resources on campus. The NIH Director has fostered the establishment of NIH-wide scientific special interest groups in the areas of Cell Biology, Molecular Biology and Biochemistry, Neurobiology, Genetics, Immunology, and Clinical Sciences to complement existing special interest groups (for an inclusive list see Appendix VI). These groups are preparing directories and are sponsoring workshops, seminars, and symposia on campus to improve communication and enhance collaboration. A new Wednesday Afternoon Lecture Series, sponsored by these special interest groups with support of the NIH Director, consists of outstanding speakers from outside the NIH, followed by poster sessions by intramural scientists germane to the speaker's subject area. A new NIH Director's Seminar Series by tenure-track and recently tenured NIH scientists helps to enhance communication among our scientists. The NIH Research Festival, in which all members of the NIH community spend several days attending symposia, workshops, and poster sessions, will be continued in a new venue—the conference center in the new Natcher Building, just completed on campus. All of these activities have heightened the sense of community on campus and improved communication among NIH intramural scientists.

(5) NIH-Private Sector Collaborations

As a result of suggestions made in the EAC Report and a report from the Office of the Inspector General, a number of far-reaching changes have been initiated in the organization of the Office of Technology Transfer. Two new policy committees have been instituted: (1) The Technology Transfer Policy Board (TTPB), which acts as a focus for developing Department of Health and Human Services technology transfer policy for which the NIH is the lead agency; and (2) The Technology Transfer Advisory Committee, which establishes policy for technology transfer for the NIH intramural community. The new organizational structure for supporting technology transfer at the NIH is schematized in Appendix VII. In addition, a search has been conducted for a new Director of the Office of Technology Transfer, and the announcement of the new director should be made very soon.

Recommendation #1 (Purpose and definition of a CRADA): On July 21, and September 8, 1994, the NIH sponsored two public forums in order to solicit advice and recommendations from the biotechnology and pharmaceutical industries, the research community, and the public on issues relating to Cooperative Research and Development Agreements (CRADAs). Among the major topics discussed was the scope of research and license rights under a CRADA. Dr. Dinah Singer, Chair of the NIH CRADA Subcommittee, presented an important background paper that addressed the scope, purpose and definition of a CRADA. The invited panelists at the public forum made a number of recommendations that will be considered by the Public Health Service (PHS) Technology Transfer Policy Board (TTPB) and the Advisory Committee to the Director, NIH. Upon request, and through targeted mailings and distributions at trade conferences, NIH disseminates a background pamphlet designed to provide key information about the NIH CRADA program. In addition, in the coming months, the newly-formed PHS TTPB and the NIH Technology Transfer Advisory Committee (TTAC) will consider a number of policies related to CRADAs, including a CRADA policies and procedures manual chapter drafted by Dr. Singer and Ms. Mary Ann Guerra. Once issued it

can be expected that this document will receive the full attention of NIH's major technology transfer partners.

Recommendation #2 (Database): The NIH Office of Technology Transfer (OTT) is in the process of creating a new directory of technology transfer opportunities — "PHS Technology Transfer Directory 1994/95". Publication of this directory is scheduled for late 1994. This directory will be updated periodically, and OTT will explore the possibility of making it available on-line through the Internet.

Recommendation #3 (Dissemination of Information): The NIH OTT has recently updated, and will soon republish, practical guidlines that explain the NIH CRADA program and licensing opportunities at NIH. A key component of the dissemination plan is to distribute these materials at the numerous professional conferences attended by OTT staff and at which OTT staff members speak. In addition, these materials have been mailed to the numerous pharmaceutical and biotechnology firms on a comprehensive OTT mailing list. Further, it should be noted that the two widely-attended and widely-reported public meetings on CRADAs held, respectively, on July 21, 1994 and September 8, 1994, both involved detailed public discussions of NIH CRADA and licensing activities.

Recommendation #4 (Timely Review of CRADAs): As the External Advisors' Report notes, the average approval time for CRADAs at NIH is 10 months. NIH is aware that many potential CRADA partners cite this lengthy review process as a major impediment to collaborating with the NIH. Toward the end of reducing this review process, the NIH formed an internal committee, chaired by Dr. Ted Colburn, the Technology Development Coordinator of NIAAA, to devise recommendations for streamlining the NIH CRADA review process. These forthcoming recommendations will be considered by the NIH TTAC and the NIH CRADA Subcommittee in the next few months.

Recommendation #5 ("Letter of Intent" CRADA): Although some ICDs (e.g., NCI) aggressively promote the use of the Letter of Intent CRADAs, more work needs to be done to encourage the use of this device across the NIH. Promoting the proper usage of "Letter of Intent CRADAs" is an issue appropriate for consideration by the newly formed NIH TTAC. While Letter of Intent CRADA can expedite the beginning of research activities, it will be important to understand that this device does not guarantee the ultimate approval of a CRADA and thus will not necessarily convey any intellectual property rights created by NIH scientists in the course of this "pre-CRADA" research, should a CRADA not be consummated.

Recommendation #6 (Patent Applications): On September 23, 1994 the consulting firm of Ernst & Young submitted its "requirements analysis" to OTT for the NIH Invention Tracking System (ITS). This contract study will be of great assistance in making improvement to the ITS. In addition, transition plans have been formulated for OTT to assume the responsibility for the filing of all foreign patent applications at the beginning of calendar year 1995 when the remaining portion of this function is to be transferred from the National Technical Information Service. With respect to training NIH staff in the area of patenting, a committee is making recommendations for the consideration of the NIH TTAC to assure that all relevant NIH staff better understand their responsibilities in the areas of employee invention reporting, patenting and licensing.

Recommendation #7 (Non-exclusive Licensing of Research Tools): It is the long-standing policy of NIH to license basic research tools non-exclusively. The OTT Division of Technology Development and Transfer has been charged with reducing this into practice through a formal policy statement for consideration by the newly-formed NIH TTAC.

Recommendation #8 (Facilitate Rapid and Broad Access to Research Tools): It is recognized that the process by which research tools are licensed non-exclusively can be expedited. The OTT is in the process of developing a model to assist in the evaluation of invention reports. One important by-product of this project will be an earlier and clearer classification of the practical utility of reported inventions so that, for example, research tool applications can be quickly identified and licensed non-exclusively. It is expected that a necessary software procurement will be accomplished in the next few months so that this project can be pilot tested. On a related matter, the NIH recently published, for public comment, the Uniform Biological Materials Transfer Agreement (UBMTA) that attempts to streamline the process for sharing research materials between non-profit research organizations and is in the process of developing such an agreement for sharing materials between for-profit and non-profit organizations.

Recommendation #9 (Review of Existing CRADAs): It may be more appropriate for the newly-formed NIH TTAC to conduct this review and evaluation since the TTAC is now the body charged with advising the Director, NIH, on matters concerning the NIH technology transfer program. Accordingly, Recommendation #9 will be placed on the agenda of one of the first TTAC meetings. With respect to Recommendation #9 (1), it must be noted that the NIH CRADA program has already yielded one important therapeutic agent, taxol, and that there are several more promising products in the development

pipeline, including some nearing the final stages of approval (e.g., taxotere, Hepatitis A vaccine [already approved in Europe]).

Recommendation #10 (CRADA Meeting): Public meetings were held on July 21, 1994 and September 8, 1994 to discuss key CRADA policy issues. While the first meeting was intended to address all aspects of CRADAs, nevertheless, much of the discussion centered around the reasonable pricing clause. Because of the high level of interest in this particular issue the September 8th meeting focused solely on the pricing clause. The recommendations of the invited panelists at these meetings, which included representatives from key constituency groups, will be considered by the PHS TTPB and the Advisory Committee to the Director, NIH (this latter group is scheduled to meet December 1-2.) Once this is accomplished, Dr. Varmus will be in a position to make recommendations to the Assistant Secretary for Health.

(6) Process for Allocating Funds Between the Extramural and Intramural Programs

As noted by the EAC Report, there is no single formula by which to determine the appropriate distribution of funding between the intramural and extramural efforts of an individual ICD The current distributions of ERP and IRP funding reflect scientific needs and opportunities, Congressional mandates, existing investments in personnel and resources, and historical trends. The conclusion of the EAC Report that the IRP budget should be determined through a rational planning process is endorsed by the current NIH leadership. However, many of the recommendations made by the EAC involve the detailed management of individual ICD budgets, a situation which is not consonant with Congressional directives delegating budget authority to the ICD Directors, nor with the trust that has been developed between the OD and the ICD Directors. Efforts to enhance this collegiality while providing leadership and oversight related to the recommendations follows:

Recommendation #1 (Annual planning process): All of the ICDs currently have an annual process for determining their IRP budget, although this is not a formal process in all cases. As a result of the EAC Report, ICDs have been strongly encouraged to develop more formal planning processes. The more stringent review process by the Boards of Scientific Counselors described in the revised guidelines (Manual Chapter #3005, Appendix II) should make it possible to trim back or eliminate support for non-productive, non-innovative research activities in the IRP. The resulting resources can then be allocated to the ERP or to other components for new initiatives in the IRP, depending on a rigorous evaluation conducted by the ICD Director as to where such resources would better be directed. It is unlikely that all resources will remain in the IRP since current administrative restrictions are forcing the downsizing of the NIH workforce (by 15% of FTEs) with a concurrent loss of the funds that can be used intramurally.

Recommendation #2 (Committee chaired by NIH Director): The unit best equipped to judge programmatic and scientific needs within an ICD is the Office of the Director of that ICD after consultation with the ICD's National Advisory Council. However, the NIH Director may encourage outside review of utilization of IRP resources from time to time as the need becomes apparent. For example, a blue ribbon panel was recently constituted as a subcommittee of the National Cancer Advisory Board (NCAB), to examine the "structure and function" of the NCI's IRP. This panel will be making its recommendations to the NCAB by the spring of 1995.

Recommendation #3 (Annual IRP budget estimates): These estimates are currently provided by the ICD's to the Office of the Director, NIH. In instances in which these budgets do not appropriately reflect the relative productivity of the IRP and ERP of a particular ICD, requests will be made to provide the justification on which these funding decisions were made.

Recommendation #4 (NIH Director's 5% transfer authority between the IRP and ERP of an ICD): Under current law, the NIH Director does not have this direct authority, since appropriations are made to individual ICDs and ICD Directors are charged with formulating their budgets. However, the FY 1994 NIH appropriations bill does include a 1% transfer authority among various ICD appropriations. In principle, this authority could be used to transfer funds into the IRP or ERP of an ICD, thereby changing the relative balance of the two programs.

Recommendation #5 (Evaluation of ICD Directors based on formal programs for IRP/ERP allocations): The annual evaluation of ICD Directors by the NIH Director is based primarily on the stewardship of public monies appropriated by the Congress. An important component of this performance is the appropriate distribution of resources, particularly, between the IRP and ERP.

Recommendation #6 (Description of formal review process for IRP/ERP allocations): ICDs will be asked to provide a written description of the process by which budget allocations between their IRP's and ERP's are made by January 1, 1995. Those processes will be reviewed and guided by the NIH Director.

Recommendation #7 (IRP budget not to exceed 11.3% of total NIH budget): The NIH FY1994 budget for the IRP is estimated at 10.9% of the total budget, and the projected budget for FY 1995 is estimated to be 10.9%. These figures are based on a 3% budget increase for the intramural program (below inflationary increases) and a 4.2% increase for the NIH budget as a whole (keeping pace with inflation).

(7) Renewal of the Clinical Center

The EAC recommended a phased program for renewal of the Clinical Center as a 250 bed hospital with essential associated laboratory space. This program has been initiated as indicated in the responses to the specific recommendations.

Recommendation #1 (250 bed hospital): The NIH has received support from the Secretary of DHHS to proceed with planning for a 250 bed in-patient hospital with adequate day hospital space, adjacent to the existing Clinical Center, that will meet the future NIH requirements for clinical research. The new hospital will contain laboratory space for the scientists, currently in Building 10, who need to be immediately adjacent to the nursing units. $2.5M has been set aside for FY '95 and funds have been requested for FY '96 to initiate planning and construction of such a facility.

Recommendation #2 (Associated laboratory space): An analysis of the recommendations of the individual ICDs regarding the need for space adjacent to wards in the new hospital facility has been completed. It has been judged appropriate that 12-15 percent (approximately 250,000 sq ft) of the laboratory space currently available in Building 10 should be adjacent to the patient care units. This space would satisfy the scientific needs of the ICDs and also provide swing space for possible future renovations of the laboratory space in Building 10, if such are deemed feasible.

Recommendation #3 (Renovation of Clinical Center): After the new hospital and laboratory space are occupied, if funds are available, if the scientific need exists, and if it is technically feasible, one possible plan will be to perform a systematic renovation of Building 10, converting it into a modern laboratory facility and allowing for phased renovation of laboratory space not included in new construction.

Recommendation #4 (Clinical protocol review): A policy has been approved by the Medical Board, Scientific Directors, and ICD Directors that will assure prospective and retrospective review of all research protocols, including the scientific and clinical merit of the studies, the costs and patient accruals. This has been codified as Manual Transmittal M94-12 entitled "Protocol Cost and Performance", which is attached as Appendix VIII.

Recommendation #5 (Funding from intramural program): Neither extramural funding nor quality intramural programs will be reduced to fund the renewal of the Clinical Center. Several reprogramming mechanisms will be pursued to mobilize funds for the Clinical Center renewal.

Recommendation #6 (ICD maintenance and renovation budgets): The Clinical Center administration will review the status of facilities throughout Building 10 and, for ICD occupied space, provide a list of common space requiring upgrades. ICDs will develop their individual plans for renovation of their existing space.

Recommendation #7 (Use of new laboratory space): The NIH Director needs a reserve of laboratory space for new initiatives and agrees with the need to return off-campus scientific programs to the Bethesda campus. In the long term, as a result of the Clinical Center renewal and the upgrade of Building 10, some space may become available for these purposes. However, this space will not become available until after the project is completed, and because of the uncertainties of timing, this is not a solution to the requirement to identify a NIH Director's space reserve as soon as possible.

The DDIR convened a subcommittee of Scientific Directors to make recommendations concerning the establishment of an NIH Director's Space Reserve. One of the recommendations of this committee was that non-wet laboratory space, currently in laboratory buildings, be relocated so that new laboratory space could be created as soon as possible.

The first step in the Clinical Center renewal project is to consolidate existing patient care units in Building 10 and to reduce the Clinical Center beds to approximate the envelope of the new hospital (about 250). This consolidation will result in closure of four patient care units in Building 10 and free up about 19,000 net sq. ft. for purposes other than patient care. Creative use of such space, along with renovations, will generate about 15,000 sq ft of "new" laboratory space in Building 10. This will become an interim NIH Director's reserve, pending the completion of the new hospital and subsequent renovation of Building 10.

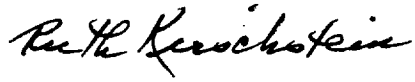
Conclusions and Acknowledgments

The Intramural Research Programs (IRPs) of the NIH have contributed in a major way to the success of bio-

medical research in the United States (see Appendix IX of this report for a description of the history and status of the IRPs prior to the final implementation of the EAC report).

As detailed in this "Implementation Plan and Progress Report", major changes have occurred in the IRPs of the NIH in response to the report of the External Advisory Committee, and many more are planned or in progress. These changes will help guarantee the continued excellence of the IRP during a time of constrained resources. The willingness of the EAC members, the NIH Internal Working Group, the NIH Scientific Directors, the NIH ICD Directors, and other NIH senior and support staff to devote their time and talent to the review of the IRPs reflects the commitment of these individuals to the most efficient use of the public investment in improved prevention, treatment and cure of disease. We are grateful for all their efforts, and are dedicated to implementing the appropriate changes needed to sustain this valued component of the nation's biomedical research effort.

Harold Varmus, M.D.
Director, NIH



Ruth Kirschstein, M.D
Deputy Director, NIH

Michael Gottesman, M.D.
Deputy Director for
Intramural Research

APPENDICES

The IRP possesses several unique characteristics that set it apart from the extramural research program. These include relatively long-term and stable funding of research programs, the availability of the Clinical Center's patient investigational facilities, few or no distractions from research for scientists, and a primarily retrospective rather than prospective review process for determining scientific quality and the funding of research. It must be emphasized that a strong ERP requires a strong IRP and quality—not necessarily uniqueness, should be of the highest priority in determining support for the intramural research program. Those with the responsibility to make decisions must use a rigorous approach to evaluating quality in terms of personnel, training, management, and priority of the research program.

Periodic, objective, unbiased peer review is crucial to the long-term excellence of all scientific institutions, including the NIH IRP. Science progresses, and scientists must respond. The review process can be positive when it calls attention to deficiencies in time for them to be corrected. When improvement is not adequate, a review provides reliable justification for shifting resources from unproductive to more productive scientists. Every effort must be made to put in place personnel systems which facilitate recruitment of outstanding people as well as providing for termination of individuals whose research programs are of inadequate quality or productivity.

The challenge of "reinventing" the IRP requires that NIH rethink some of its practices regarding: 1) NIH-wide appointment and promotion of scientists; 2) recruitment and retention of outstanding scientists; 3) invigorating postdoctoral training programs that transcend institute lines; 4) use of patient and research facilities in the Clinical Center; 5) instituting efficient management and review practices that are more responsive to the needs of the research enterprise; and 6) exploring opportunities for increased collaboration with the extramural community, including industrial and academic laboratories.

The recommendations contained in this report aim to create more uniform and consistent processes for setting priorities and ensuring quality across the NIH IRP. While each institute should retain a level of autonomy in its research programs, more centralized control of the process for ensuring quality is desperately needed.

To enhance quality control, the External Advisory Committee makes a number of recommendations related to review of quality and productivity of scientists, scientific directors, and training programs. It is unlikely that the NIH intramural budget will increase significantly beyond the cost of inflation in the foreseeable future. The need to renovate the Clinical Center is also likely to drain funds from the operating budget of the intramural research program. One way to make room for new investigators will be to reclaim resources from those investigators whose research is no longer productive. This report outlines mechanisms to achieve the goal of re-directing intramural research resources to the most productive programs, thereby improving accountability and freeing resources for new recruitment and new initiatives, and for renewing the Clinical Center.

Major Recommendations

The External Advisory Committee makes the following major recommendations. Additional recommendations and justification and methods for implementation of recommendations are presented in the body of the report.

1. To improve the processes by which senior scientists and scientific directors are reviewed, the External Advisory Committee recommends that a standing Advisory Committee to the Deputy Director for Intramural Research be formed composed mainly of the chairs of the external boards of scientific counselors of each institute, center, and division. This committee should be charged to provide ongoing review of the *processes* of quality control across NIH. The Committee should be chaired by the Deputy Director for Intramural Research (DDIR).

2. Further, to improve quality review, the Committee recommends that the selection and appointment process be altered for the boards of scientific counselors to assure expert, arms-length membership; that the process by which boards of scientific counselors review the programs of intramural scientists be more explicit; and that the criteria used to evaluate scientific directors be made more rigorous.

3. To ensure a strong tenure system that provides the intramural research program with creative and productive scientists, an NIH-wide Tenure Committee, advisory to the Deputy Director for Intramural Research, and composed of 12 to 16 tenured scientists serving staggered terms, should be established to review and recommend for approval (or rejection) all potential appointments to tenure and tenure-track positions. Recommendations for appointments to tenure or tenure track should be made by each institute, center, and division through its existing processes, then forwarded to the Tenure Committee with all appropriate documentary support. Once the NIH Tenure Committee is in place it should no longer be necessary for the NIH Board of Scientific Directors to review or approve tenure decisions.

4. To improve the intramural training program, the independence and career development of trainees should be emphasized. Trainees should be encouraged to seek positions outside NIH following a two- to four-year program so as to continuously provide space and resources for recruitment of new trainees.

5. To provide ethnic diversity in the intramural training programs there should be better linkage with NIH-funded extramural programs, including the NIH Minority Access to Research Careers and Minority Biomedical Research Support undergraduate programs, and with the Short-Term Training Program for physicians. The intramural program also should increase the number of physician scientists from underrepresented minority groups by increasing research experiences for minority medical students.

6. An annual, prospective planning process should be conducted by each institute, center, and division to determine the allocation of resources to the intramural and extramural programs. The process should be outlined in a written document and reviewed, approved, and monitored by the NIH Director and the Advisory Committee to the Director, NIH. Extensive consultation with the extramural research community should be part of this process. The overall NIH scientific mission should be assessed and allocation decisions made on the basis of scientific excellence and opportunity. The total IRP budget for institutes, centers, and divisions (ICDs) should not exceed the current rate of 11.3 percent of the total NIH budget. This percentage should be reviewed and appropriately adjusted through the prospective planning process, following full implementation of the recommendations which emerge from the quality review of the intramural program as outlined in recommendation number 1. It is anticipated that implementation of this process of quality assurance may require 3 to 4 years.

7. The procedures for procurement and staff travel should be streamlined and improved, as should the procedures for appointment of technical as well as scientific staff as part of the process of "reinventing government." NIH could serve as a model for developing and testing novel procedures to make the procurement process efficient and responsive to research needs, while simultaneously ensuring the integrity of federal expenditures.

8. To ensure that the NIH intramural program is fulfilling its mandate to facilitate technology transfer, NIH should broadly communicate in a clear and precise manner the scope, purpose, definition, and processes of implementing and monitoring Cooperative Research and Development Agreements (CRADAs).

9. There is a need for renewal of the Clinical Center. There should be a phased program starting with a 250-bed Clinical Center Hospital and followed by a modular approach to construction and renovation of research laboratories. Funds recovered from phasing out weaker intramural research programs should be used to the extent possible to fund renewal of the Clinical Center. However, recognizing the likelihood that these funds will not be adequate to meet the costs of renewal of the Clinical Center, the Committee recommends that additional funds be allocated by Congress for this purpose. Funds must not be diverted from the extramural program to the intramural program for renewal of the Clinical Center.

10. If, on renewal of the Clinical Center, inpatient nursing units and laboratory research space become available in excess of the needs of the ongoing programs of the Clinical Center, then establishing priority for the use of such space should be the discretion of the Director of NIH, with the understanding that priority should be given to programs currently housed off the Bethesda campus (both clinical facilities and research laboratories). Such consolidation of NIH intramural programs should facilitate quality control and could reduce costs.

11. Recognizing that it is not within the authority of the Director of NIH to change the current classification of the intramural research program as an administrative expense, the Committee strongly believes that it *should not* be classified in this manner. Such a classification leads to budgetary procedures which are not rationally related to the scientific process and which do not support the goal of achieving the highest quality and productivity of the intramural research program.

INTRODUCTION

The Mandate to the External Advisory Committee

Concern expressed by Congress and others regarding the quality, appropriateness, size, and cost of the National Institutes of Health (NIH) intramural research program (IRP) has existed for some time. The mandate which led to the establishment of this External Advisory Committee reflects increasing concern exacerbated by mounting financial constraints on the Nation's biomedical research enterprise. Specifically, the Fiscal Year (FY) 1994 House Appropriations Committee Report directed the new Director of NIH "to review carefully the role, size, and cost of the intramural program," and its relationship to the extramural research program," and indicated that NIH must put together a process "for allocating resources to and among its intramural programs based on a thoughtful analysis of these issues."

While there has been a 2-year history of review of the mission and management of NIH, recent congressional scrutiny has focused specifically on three issues concerning the IRP: 1) whether the level of quality across the IRP continues to place it among the best institutions; 2) whether the allocation of resources to the IRP relative to the extramural research program (ERP) can be justified based on rigorous considerations with regard to quality and importance of research questions addressed in the IRP; and 3) given the high cost of the needed renewal of the physical facilities of NIH, particularly the Clinical Center, what new and renewed facilities are required to assure high quality research and productivity in the future.

The Process of the External Advisory Committee

In response to the mandate of the House Appropriations Committee, a subcommittee of the NIH Director's Advisory Committee (hereafter referred to as the External Advisory Committee or the Committee) was established to review the IRP. A separate internal NIH fact-finding committee was formed in July 1993 to conduct an internal evaluation and assisted the External Advisory Committee in this evaluation by providing data and responding to requests for information. The External Advisory Committee met five times over a five-month period between October 1993 and February 1993; it requested and received detailed data on budgets, planning, quality review, personnel and administrative practices, training, industry collaboration, and the status of the Clinical Center from each of the institutes, centers, and divisions (ICDs) of NIH; heard testimony from a variety of IRP personnel, including scientists, institute directors, scientific directors, the Acting Deputy Director for Intramural Research, Clinical Center staff, and administrative staff; solicited comments in writing from the entire professional staff of the IRP; and made site visits to the Clinical Center. This report is being submitted in anticipation of congressional appropriations hearings on the NIH budget.

The Committee assessed the many facets of how the IRP invests in and maintains its intellectual capital. Specifically, the Committee looked at the review process for senior scientists and scientific directors, the review process for tenure, and the role of postdoctoral fellows in the IRP. To better understand the quality of the environment in which IRP scientists work, the Committee reviewed various means to enhance the attractiveness of the IRP for senior scientists, organizational disincentives to conduct the highest quality research and training, and the feasibility of NIH-private sector collaborations as a means for intellectual stimulation and to foster technology transfer.

The decisionmaking process used to allocate funds between the extramural and intramural programs was reviewed in some detail. Similarly, the need for renewal of the Clinical Center was evaluated carefully. Both these major issues are integrally related to the issues of quality of the IRP personnel and programs.

There is no doubt that the IRP, like all research institutions, includes a great diversity of scientific competence. Like any program of research the size of the IRP, it has its strengths and weaknesses. Although this is not the first review of the IRP, the Committee views the timing of this review as a remarkable opportunity for NIH to reevaluate its mission and goals. Current efforts to "reinvent government" and "invest" in health-related research provide both a challenge and an opportunity for NIH to pursue a deliberative process that will focus on improving the quality and productivity of its research establishment. The presence of a new Director of outstanding scientific

achievement who commands the respect of the national and international biomedical community strengthens this opportunity.

Evolution of NIH and the Intramural Research Program

NIH originated as a one-room "Laboratory of Hygiene" more than a century ago and continued as a limited, free-standing "intramural" research program until World War II. NIH remained primarily an intramural effort until after World War II, although it collaborated with academic institutions during wartime to solve war-related health problems such as the need for large-scale production of penicillin and the need for new drugs for malaria. In 1944, legislation was enacted authorizing the Public Health Service (PHS) to make grants to universities, laboratories, and hospitals for the conduct of research. The goals of the grants program were to enable medical research to expand in size and scope and to focus more research attention on chronic diseases.

After the war, Vannevar Bush, director of the Office of Scientific Research and Development, outlined a program for postwar scientific research which affirmed the contributions of "remote and unexpected fields of medicine and the underlying sciences" in the progress against disease, and the benefits of cooperative endeavors with industry and academia. Noting that traditional sources of support for medical research—i.e., endowment income, foundation grants, and private donations—were diminishing while research costs were rising, Bush advocated the provision of government grants to medical schools and universities for the conduct of basic research and training.

Congressional interest in NIH also increased in the 1940s and was expressed primarily through the establishment of research institutes on particular diseases. The disease orientation and categorical structure of NIH had its genesis in the establishment of the National Cancer Institute (NCI) in 1944. In 1948, Congress passed the National Heart Act which created the National Heart Institute and soon after established institutes for research on mental health, oral diseases, neurological problems, and blindness. Today there are 24 institutes, centers, and divisions (ICDs) within NIH.

The early success of the extramural component of NCI inspired confidence in the concept of an extramural/intramural mix, which became the model for the creation of all subsequent ICDs. Until 1947 the intramural program received the larger share of NIH appropriations. In that year funds were evenly divided with each sector receiving approximately $4 million. For at least the past decade, the intramural allocation has remained stable at approximately 11.3 percent of the total NIH appropriation.

As a result of sustained support from NIH, the U.S. biomedical research enterprise has produced a wealth of biological knowledge and has greatly increased our capacity to prevent, ameliorate, and cure many diseases. The IRP has been an integral part of that success. The NIH IRP includes 1,100 tenured scientists, 250 staff scientists, 2,146 non-tenured scientists, 2,410 postdoctoral trainees, and 194 other trainees, most of whom work on the 317-acre campus in Bethesda, Maryland. In addition, NIH provides over 32 percent of the money allotted for the support of health research and development in the United States, and provides over 82 percent of the total federal funds expended for support of medical research in universities, medical schools, and research institutions.

In a 1991 analysis of scientific productivity, as measured by numbers of scientific publications and citations of that work, NIH ranked near the top not only in quantity, as measured by number of papers, but also in quality, as measured by the number of citations per paper, particularly in the categories of acquired immunodeficiency syndrome (AIDS) research, gene therapy, and cardiovascular and respiratory medicine. NIH intramural scientists' citation histories rank in the top one hundredth of one percent.

The scientific accomplishments of the IRP are numerous and cover a broad spectrum of scientific inquiry. Intramural scientists have made many important contributions to the advancement of biomedical science, of which space permits only a few to be cited here: 1) solving the genetic code;[1] 2) elucidating the mechanism by which adrenalin and other hormones and drugs are metabolized;[2] 3) unraveling the mechanism for protein folding;[3] 4) discovering the slow viruses and their causative role in disease;[4] 5) developing the blood test for AIDS; 6) elucidating the role of viruses in tumor development; and 7) defining the crystallographic structure of immunoglobulin molecules. These fundamental advances have exerted a widespread impact in many areas of medicine and biology. In addition, the NIH IRP has made significant contributions in more targeted areas of clinical research, such as gene therapy, AIDS research, immunology, and cancer treatments.

The quality of research in the intramural program also is reflected in the numerous honors and awards bestowed on its past and present scientists, including 13 Nobel Laureates who have worked in the IRP, 34 Lasker Foundation awardees, and 109 members of the National Academy of Sciences who have worked in the IRP, 44 of whom are still conducting research at NIH. These data

indicate that NIH scientists are among the nation's most highly regarded researchers.

Although the intramural and extramural programs of NIH have prospered in the past, three recent concerns dictate the need for change: 1) the failure of the total NIH budget to keep pace with the growing demands of the extramural research community, a circumstance which has led to especially severe constraints in the funding of young investigators; 2) uncertainty about the quality of some parts of the IRP; and 3) the physical deterioration of the NIH Clinical Center, which requires replacement or extensive renovation. The resolution of one of these issues cannot be achieved at the expense of the others without damaging the quality and integrity of NIH.

Past Reviews of the NIH Intramural Research Program

Both the extramural and intramural programs of NIH have been reviewed on several occasions during the past 20 years in response to mandates from the Administration and Congress. The size of the NIH budget (now approaching $11 billion), the public's expectations about the return on that investment, perceptions with respect to the quality and productivity of the biomedical enterprise, questions as to the proper mission and focus of the IRP, disenchantment with the federal bureaucracy, tensions between the executive and legislative branches, and increasing fiscal constraints have all served as reasons for requesting these periodic reviews of NIH. For example, a 1976 review of NIH by the President's Biomedical Research Panel,[5] a 1988 report of the Institute of Medicine (IOM) regarding the NIH intramural program,[6] and more recently the 1992 report of the Task Force on the Intramural Research Program of the National Institutes of Health[7] all addressed many of the same issues addressed by this Committee. In addition, a special Advisory Committee to the Secretary of Health and Human Services was established in 1989 to develop recommendations on strengthening the role of the NIH Director. Although no report was ever issued that Committee made many recommendations for strengthening the IRP that are relevant to the work of this Committee.

The lessons of the past are instructive for the future. While many of the recommendations made by the President's Panel, the IOM, and the 1992 Task Force have been acted on, many of the problems described and recommendations made could easily be restated today. This may be attributed in part to systemic problems that transcend NIH and require major executive or legislative remedies and in part to resistance to change among some IRP staff members. Interestingly, there has been some continuity to the deliberations of these various bodies since several members of the currently constituted External Advisory Committee have served on one or more of these review groups. Thus, members of this Committee began the current deliberations with knowledge of the work of previous groups.

The President's Biomedical Research Panel

The President's Biomedical Research Panel was established in January 1975 under Public Law 93-352, to review and assess the conduct, support, policies, and management of biomedical and behavioral research as conducted and supported through programs of NIH and the Alcohol, Drug Abuse, and Mental Health Administration (ADAMHA). Over a period of 15 months, the seven-member[8] panel conducted an extensive study that involved assessments of the state of the science, the impact of federally-funded research on institutions of higher education, the organization and management of NIH and ADAMHA, the dissemination and publication of research findings, and the development of policies both for federal support of biomedical and behavioral research and the relationships of NIH and ADAMHA to industrial sponsorship of biomedical research.

Among the many recommendations made by the President's Biomedical Research Panel in 1976, the following are particularly relevant to the IRP and to the deliberations of this Committee in 1994:

- Congress should consider thoroughly the best scientific and professional views before mandating new programs, and provide funds and personnel for such programs. Otherwise, these initiatives will seriously reduce the efficiency of the overall research enterprise.

- To meet the needs of more outpatient and ambulatory work of the Clinical Center, the Panel endorsed the construction of a new ambulatory care facility, as well as adequate resources for maintaining and modernizing the Clinical Center.[9]

- Appointments to membership on boards of scientific counselors (BSCs) must be based primarily on scientific competence rather than on political considerations. Each BSC should have the necessary scientific representation essential to its function and should report annually on the results of its reviews to the institute director and to the Director of NIH.

- NIH should have the authority to support training grants, fellowships, and research career development awards as part of its general authority.

- Congress should consider establishing a special personnel system for NIH [and ADAMHA] that would improve the method for periodic evaluation of the activities of all research personnel and scientist administrators. The review would determine who should continue to have career status in the system, who should be reassigned to other duties, or would be retired because they no longer meet the highest standards of quality and productivity in research endeavors.

- The pay rates of the Executive Schedule should be increased substantially because of the adverse effects of the salary ceiling on the recruitment of able scientists and administrators.

- A more flexible method should be available for controlling the size of the federal work force than restrictions on the number of full-time-equivalency personnel.

Institute of Medicine Report

In 1988, responding to concern that the NIH intramural program was experiencing difficulties in attracting and retaining outstanding basic scientists and clinical investigators, the IOM10 issued a report with wide-ranging recommendations regarding:

- Increasing the flexibility in personnel administration, including simplified hiring classification and pay administration, occupation-based pay standards, the ability to exceed federal pay ceilings in justifiable circumstances, portable retirement benefits, and the replacement of employment ceilings with personnel expenditure budgets.

- The formation of a congressionally-chartered foundation to permit private support of endowed chairs for distinguished scientists.

- Streamlining of administrative matters with more authority delegated by the Secretary of Health and Human Services to the Director of NIH.

- The institutionalization of a Director's Discretionary Fund to be used to address emerging issues and special inter-institute research opportunities.
- Improvement in the review of the IRP, including review by a subpanel of the Director's Advisory Committee, and more routine review of the scientific directors and their intramural programs.

- Creation of an NIH Scholars Program in which outstanding young investigators at the assistant professor level would be appointed on a competitive basis to an independent, non-tenured position in the IRP.

Progress has been made in several areas addressed in the recommendations made by the IOM panel. Specifically, the Secretary of Health and Human Services delegated authority to make many key scientific personnel decisions to the NIH Director and has signalled her intent to fully implement the Senior Biomedical Research Service (SBRS) provisions that would allow higher salaries for distinguished senior investigators. In addition, discussions have been initiated to establish a foundation to permit private support of endowed chairs for distinguished scientists.

Recommendations of the Secretary's Advisory Committee on NIH

The Secretary's Advisory Committee on NIH[11] met several times in 1989 to develop a series of recommendations to strengthen the role of the NIH Director. At the time, a prolonged search for a new Director was underway and the perceived unattractiveness of the job was cited by many as one of the reasons for the difficulty in finding a suitable candidate. Among the recommendations made by the Secretary's Committee, the following are relevant to the current Committee deliberations:

- Bolster the NIH Director's ability to recruit and retain senior level staff by adjusting the salaries associated with these positions.

- Delegate to the NIH Director the authority to make appointments to the Senior Scientific Service and the Senior Executive Service and to make related decisions including pay setting, promotion, reassignments, job classifications, and bonuses.

As noted previously, action has been taken in both of these areas since the original recommendations were made by the IOM committee in 1988 and reiterated by the Secretary's Advisory Committee in 1990.

Task Force on the Intramural Research Program of the NIH

The Task Force on the Intramural Research Program of the NIH was appointed by Bernadine Healy, Director of NIH, to prepare a report concerning the scientific vitality, excellence, and eminence of the IRP and to recommend actions aimed at reinforcing its strengths and at insuring a robust future. The Task Force relied on the views of working intramural scientists in their deliberations and developed two sets of recommendations for improving the IRP, one set requiring new legislative authority, and one which would be feasible within the current governing authority of the IRP. The latter includes:

This is a time of unusual opportunity for the NIH intramural program to develop processes and programs that clearly emphasize the quality and importance of the research questions being asked.

A rapidly expanding knowledge base in biology and medicine and the potential for clinical application has presented unprecedented opportunities for advances in disease prevention, diagnosis, and treatment. It becomes particularly important that the IRP streamline many of its practices, particularly those concerning personnel, training, and technology transfer. The rapidly expanding biotechnology industry has relied on, and will continue to rely on thoughtful and flexible approaches to collaboration with NIH in key areas of biomedical research and development. Given the historical opportunities for advancing human health, NIH should make all efforts to minimize, to the extent possible, the cumbersome nature of its administrative practices. In addition, institutional barriers which are disincentives for cross-institute collaborations or trans-NIH use of resources should be identified and, as far as possible, reduced.

The challenge of "reinventing" the IRP will require NIH to rethink some of its practices to ensure quality, particularly in the areas of: 1) the review process for senior scientists and scientific directors; 2) the review process for tenure; 3) postdoctoral training; 4) organizational issues affecting recruitment and retention, e.g., management practices that are more responsive to the needs of the research enterprise; and 5) vigorous and appropriate collaboration with the private sector. NIH also must evaluate and formalize the processes by which allocation decisions are made between the intramural and extramural programs. Finally, as NIH prepares to renew the Clinical Center, the plan for revitalization should be informed by a careful evaluation of the quality and necessity of clinical research programs in the IRP.

This report examines the issues identified above and suggests ways to achieve the goal of re-directing IRP resources to the most productive programs, thereby freeing resources for expanding IRP recruitment activities and for renewing the Clinical Center. The Committee also makes recommendations designed to minimize bureaucracy in order to enhance the productivity of IRP scientists and enable the IRP to attract the most outstanding individuals to its ranks.

Notes

1 Dr. Marshall W. Nirenberg of the National Heart, Lung, and Blood Institute shared the Nobel Prize in Physiology or Medicine in 1968. Dr. Nirenberg was the first NIH Nobelist and also the first federal employee to receive a Nobel Prize.

2 Dr. Julius Axelrod, National Institute of Mental Health, shared the Nobel Prize in Physiology or Medicine in 1970.

3 Dr. Christian B. Anfinsen, formerly with the National Institute of Arthritis, Metabolism, and Digestive Diseases, won the Nobel Prize in Chemistry in 1972.

4 Dr. Carleton Gajdusek won the Nobel Prize in Physiology or Medicine in 1976.

5 *Report of the President's Biomedical Research Panel,* submitted to the President and the Congress of the United States (U.S. Department of Health, Education, and Welfare, Public Health Service, DHEW Publication No. (OS) 76-500), April 30, 1976.

6 Institute of Medicine, *Report of a Study: A Healthy NIH Intramural Program: Structural Change or Administrative Remedies?* (Washington, DC: National Academy Press, 1988).

7 *Report of the Task Force on the Intramural Research Program of the National Institutes of Health,* transmitted April 13, 1992 to Dr. Bernadine Healy, Director, National Institutes of Health, from Richard D. Klausner, Ph.D., Chief, Cell Biology and Metabolism Branch, National Institute of Child Health and Human Development, NIH.

8 Panel members included Franklin D. Murphy, Chair; Ewald W. Busse; Robert H. Ebert; Albert L. Lehninger; Paul A. Marks; Benno C. Schmidt; and David B. Skinner.

9 The new Ambulatory Care Research Facility was built in 1980.

10 Committee members included Harold T. Shapiro, Chair; Michael S. Brown; John T. Dunlop; Gerald D. Fischbach; Marian E. Koshland; Charlotte V. Kuh; Robert I. Levy; Walter E. Massey; Robert G. Petersdorf; Paul Grant Rogers; Benno C. Schmidt; Lloyd H. Smith; Elmer B. Staats; and P. Roy Vagelos.

11 Members included Louis W. Sullivan, Secretary; James O. Mason, Assistant Secretary; Theodore Cooper; Eugene Cota-Robles; James F. Dickson III; Donald S. Fredrickson; James R. Gavin, III; Paul Gray; Paul A. Marks; Edmund D. Pellegrino; Paul G. Rogers; David Satcher; Benno Schmidt; Maxine Singer; Samuel O. Thier; P. Roy Vagelos; and Linda S. Wilson.

REVIEW PROCESS FOR TENURED SCIENTISTS AND SCIENTIFIC DIRECTORS

Periodic peer review is crucial to the long term excellence of all scientific institutions, including the NIH IRP. Science progresses, and scientists must respond. The review process can be positive when it calls attention to deficiencies in time for them to be corrected. When improvement is not adequate, a review provides reliable justification for shifting resources from unproductive to more productive scientists.

Stringent review of the NIH intramural program is needed now, more than ever, because of the institutional "aging" typical of most large organizations and because of budgetary constraints. No scientific institution can long excel without a continued infusion of fresh, independent investigators. It is unlikely that the NIH intramural budget will increase significantly beyond the cost of inflation in the foreseeable future. The cost of renovating the Clinical Center also is likely to drain funds from the operating budget of the IRP. One way to make room for new investigators will be to reclaim resources from those investigators whose research is no longer productive. Such reclamation is essential for the long term health of the NIH.

The current system that guides review of intramural research scientists rests heavily on the discretion of the scientific director, who exerts a high level of control on the membership and the agenda of the board of scientific counselors for each institute. The benefit of this concentration of power is that it allows for flexibility and creativity on the part of the scientific director, but a danger lies in the system's complete reliance on the ability of that director to discern and adequately reward excellent scientists. Experience has taught us that the best way to maintain the productivity of a research program is through objective peer review. It was not evident to the External Advisory Committee that review of scientists within the intramural program is uniformly objective or that there is sufficient distance between the boards of scientific counselors and the scientific directors to ensure objectivity in review.

Currently, peer review of the NIH intramural program is conducted by the BSC of each institute. Each BSC consists of extramural scientists chosen for their expertise in the scientific fields covered by the institute. In the past, BSC members have been selected by the scientific director of the institute and appointed by the NIH Deputy Director for Intramural Research. A 1988 Institute of Medicine committee report on the NIH intramural program[1] and a 1989 report of a Consultant Panel to the Advisory Committee to the Director, NIH, both concluded that the system of making appointments to the BSC was inadequate.

Although outstanding scientists have been appointed to the various BSCs, their roles are not clearly defined. The selection process implies that the consultants are advisory to the scientific director of the institute, rather than to the institute director and the DDIR. In many cases advisors are funded by the institute under review. To better serve the process of review for each institute's IRP a more independent group of reviewers is needed.

The two previous advisory committees indicated above concluded that the BSCs should be more active in reviewing the performance of the scientific director. Just as individual scientists must change continuously in order to keep up with new concepts, the scientific directors must adapt over time. The BSCs must evaluate regularly the performance of the scientific director along with the overall achievements of the entire institute. Objective review is difficult when the BSC is nominated by and reports to the scientific director.

As a result of suggestions made by the two previous committees the review process has been strengthened to a measurable degree. In particular, the scientific director is now required to respond formally to the criticisms of the BSC and to justify actions taken in response to the criticism. Despite these positive steps, further improvement is essential to satisfy the criteria for stringent review.

The External Advisory Committee recognizes and wishes to preserve the special nature of research performed at NIH as contrasted with extramural research. The excellence of the overall NIH program is built upon a variety of approaches to the management of research. Prospective and retrospective evaluation procedures have different strengths and weaknesses, and encourage cre-

1 Institute of Medicine, *Report of a Study: A Healthy NIH Intramural Program: Structural Change or Administrative Remedies?* (Washington, DC: National Academy Press, 1988).

ativity in different ways. The overall NIH system is best served by retaining prospective review in the extramural program and retrospective review in the intramural program.

The recommendations below are designed to preserve the special status of the IRP by:

1) retaining the retrospective review process, which is focused largely on accomplishments over the past 3 to 5 years, rather than adopting a prospective review that would be focused on specific proposed projects;

2) having the review conducted by panels of recognized experts (the BSCs) whose membership is expected to be more mature and distinguished than the membership of many extramural study sections;

3) allowing the intramural scientist to make an oral presentation to the BSC, and to respond to questions and criticisms orally without the necessity of writing a long grant report; and

4) asking the review panels to take into consideration the long-term nature of some of the projects at NIH, thereby lessening the pressure to produce immediate results.

To improve the processes by which senior scientists and scientific directors are reviewed, the External Advisory Committee recommends that a standing advisory committee for intramural research be formed to review quality control, that the selection and appointment process be altered for the boards of scientific counselors to assure expert, arms-length membership, that the process by which BSCs review tenured scientists be more explicit, and that the criteria used to evaluate the scientific director reflect a commitment to an improved process of quality review.

RECOMMENDATIONS

1. Establish an External Advisory Committee to the Intramural Research Program.

The Deputy Director for Intramural Research and the chairpersons of all of the BSCs shall constitute a new committee, herein called the "External Advisory Committee to the Intramural Research Program," to be chaired by the DDIR.

The committee should have its first meeting within three months of the acceptance date of this report. At the meeting the DDIR should explain the new ground rules for the review process, stressing the need for stringent quality control and the necessity to free up resources for new recruitment. The government mandate to reduce the number of personnel at rank GS-14 or above should be thoroughly analyzed in terms of the implications for retention of senior scientists and recruitment of young and established scientists. The committee and the DDIR should draft written guidelines for the BSC members and chairpersons outlining duties and responsibilities. These guidelines should stress the crucial role of the BSCs in determining the future of the NIH intramural research program. Thereafter, the External Advisory Committee to the Intramural Research Program should meet at least annually and more often as needed. At each meeting the chairperson of each BSC should make a brief oral report of the state of the institute, outlining its significant accomplishments, and highlighting any weaknesses that have been found. These meetings should help to maintain uniform standards among the institutes.

2. Revise the processes for selection and appointment of boards of scientific counselors.

New members of each BSC shall be recommended by a vote of the current BSC members. Attempts should be made to include scientists with a broad range of background, and views. Nominations may be made by the members of the BSC, the scientific director of the institute, the DDIR and others. The invitation to join the BSC should come from both the DDIR *and* the chairperson of the BSC, and not from the institute scientific director. The chairperson of each BSC shall be elected from and by the membership of the BSC and shall serve for a set term, extending the total term on the BSC as required. The term of appointment for members should be for four years, and membership is renewable for one term. Each BSC should include women and members of underrepresented minorities in concert with government policy. The rule that excludes scientists who serve on extramural review panels such as NIH study sections and councils should be abolished.

At least one third of each board of scientific counselors should be composed of scientists whose major grant funding comes from sources outside of the institute under review. It would be preferable if the chairperson of the BSC did not receive the majority of his or her research funds from the institute. A significant proportion of participants on any site visit should be permanent members of the BSC, but the use of ad hoc experts is encouraged particularly to ensure that individuals being reviewed for tenure are reviewed by individuals knowledgeable in their field.

Every four years, the members of the BSC should review the overall status of the institute's intramural research program and should vote whether to recommend the institute's scientific director for a new four-year term.

A major criterion for evaluation of the scientific director should be the extent to which he or she has considered or implemented the recommendations of the BSC with regard to resource allocation to individual scientists. This should include review of the quality and career development of trainees and junior scientists in the institute. The review of the scientific director should also include, in part, a review of the interactions and programs involving extramural scientists and inter-institute collaborations within the IRP. A report should then be transmitted to the DDIR who in turn will make a recommendation to the institute director.

3. Make more uniform and explicit the review process for tenured scientists and scientific directors.

The BSC should review each tenure track investigator in the institute every three years, and each tenured investigator every four years, according to a schedule provided in advance to each scientist. The reviews should be conducted on site. Each BSC member should be required to attend at least two site visits annually.

Prior to the review session each scientist shall submit a brief (less than 3 single-spaced pages) written summary of work undertaken since the last review, together with a list of publications and important reprints. In addition there should be a brief outline of future directions. Two BSC members should be assigned as primary and secondary reviewers of each scientist.

At the site visit, the scientist under review should be allowed sufficient time to make an oral presentation (at least 30 minutes) followed by a period of questioning by the site visitors.

The practice of being judged on past achievements without having to specify future projects in detail distinguishes the NIH intramural program from extramural NIH-supported science. The External Advisory Committee feels strongly that this practice should be maintained. Therefore, the review process should concentrate on work already undertaken, rather than on a detailed outline of future work. The BSC should also be cognizant of the role of NIH in supporting long term projects.

The site visit team should be informed of the budget of each investigator, including outside contracts, and of other significant resources (e.g., postdoctoral fellows, space, technicians, meetings, travel).

After each presentation, the site visit team should decide by vote whether to recommend that support be continued for the standard period (three or four years) and whether to recommend an increase or decrease in resources. The BSC may wish to adopt a scoring system by which to rate each scientist's research program, i.e. excellent, very good, good, fair, poor. The site visit team may also give warning that a scientist's progress is in doubt and may request a review sooner than the standard period. If progress is not sufficient after the second review the site visit team may recommend that research support be withdrawn. The primary reviewer should produce a written report, listing the reasons for these recommendations. The report should be approved by the chairperson of the site visit team and the BSC chairperson before it is issued.

The primary criterion for judgement should be scientific excellence. Inadequate science should not be supported simply because it is consistent with the mission of the institute. Laboratory and branch chiefs should be judged in regard to the extent to which they recruit, encourage, and support independent junior scientists, as well as on their own research efforts. BSC members should be knowledgeable about the standards for evaluating scientists in the extramural program. Similar standards should be used to judge the quality of the intramural research program even though the review is retrospective rather than prospective.

The recommendations of the BSC should be made known to the laboratory chief, branch chief, and scientific director of the institute; the institute director; the DDIR; and the council of the institute. The BSC's recommendations are advisory and the decision whether to accept the recommendations should be made by the institute director in consultation with the DDIR. The scientist should be given an opportunity to reply in writing to criticisms, and this response should be considered by the BSC at its next meeting.

Prior to the next BSC meeting, the scientific director should submit a written statement to the chairperson of the BSC, the institute director, and the DDIR. The statement should outline the administrative actions taken in response to the recommendations of the BSC. If the recommendations were not followed, reasons should be given.

REVIEW PROCESS FOR TENURE

The tenure system at NIH has been improved over the past few years in response to internal suggestions as well as to outside review panels. The External Advisory Committee approves the steps taken by NIH to establish a formal tenure track and procedures for insuring the independence of tenure-track scientists.

A strong tenure system provides the clearest assurance that the IRP will always have an input of fresh, independent ideas and will not become simply the extension of the ideas of a few senior scientists. In the NIH system the designation of a scientist as tenure track signifies that the individual is permitted to design and carry out an independent program. Tenure-track individuals are judged on their own merits by the boards of scientific counselors based on originality, independence, and scientific success.

The selection of tenure-track scientists is crucial in assuring the long term success of the NIH. In the past, NIH promoted predominantly from within, selecting scientists who entered NIH as postdoctoral fellows or Junior Associates.[1] Often these individuals have worked for many years under the direct supervision of a laboratory or branch chief. This policy has often created fiefdoms in which many scientists work under the direct control of a laboratory or branch chief. Such large organizations of team scientists whose work is directed from above may be necessary on rare occasions to solve complex scientific problems. In most excellent biomedical research institutions, however, the major advances are produced by creative individuals working on their own with a small group. The External Advisory Committee therefore recommends that NIH would be better served if laboratories and branches contained a larger proportion of independent scientists either tenured or on the tenure track, analogous to the best departments within universities. Several NIH laboratories have operated in this way for many years and their excellent records indicate that this approach is feasible within NIH.

As the number of tenure-track scientists increases, it will be even more imperative that all of the institutes use equal standards and adopt a uniform policy with regard to assigning scientists to the tenure track and promoting them to tenure. The recommendations below are largely designed to achieve this goal.

1 According to data collected by the External Advisory Committee, about 70 percent of the tenured appointments made in the past five years were drawn from the non-tenured scientific staff.

RECOMMENDATIONS

1. Make more inclusive the decisionmaking process for filling a tenure-track position.

The decision to create a new position within the tenure track or replace a departing tenured investigator should be made by the senior investigators of an institute, acting as a group, in consultation with the scientific director and with the Deputy Director for Intramural Research. The decision should be consistent with the long term staffing plan of the institute.

2. Widen the field in the search for tenure-track candidates.

Once a tenure-track position is available, a search committee should be established to identify outstanding scientists, including internal candidates and candidates who have completed postdoctoral training outside of the NIH and in NIH laboratories other than the recruiting laboratory, and to recommend a candidate. The search committee should be established by the scientific director and composed of scientists within the intramural program of the institute. It should also include scientists from other institutes who are experts in the scientific discipline under consideration. A good source of search committee members will be the newly formed faculties that are focused on scientific disciplines rather than on institute affiliation.

3. Maintain the current mechanisms for making formal agreements with tenure-track scientists.

The formal agreements with the tenure-track scientist, including guarantees of independence, should be negotiated according to current policy. The six-year term prior to the tenure decision and the procedures for lengthening that term also should be continued.

4. **Create an NIH-wide Tenure Committee, advisory to the Deputy Director for Intramural Research, and composed of 12 to 16 tenured scientists, to review and recommend for approval (or rejection) all potential appointments to tenure and tenure-track positions.**

Proposals for tenure-track appointments should be forwarded to the Tenure Committee by the scientific director, the laboratory or branch chief, and the search committee that has nominated the tenure-track candidate.

When a candidate is to be proposed for tenure, the laboratory or branch chief should assemble the credentials and prepare a formal nomination for consideration by the scientific director and by the tenure committee of the institute. If endorsement is received, the nomination should be presented to the NIH-wide Tenure Committee.

The NIH Tenure Committee should be chaired by the DDIR and composed of tenured scientists selected by the DDIR from nominations provided by the scientific directors. The membership should exclude individuals with institute-wide responsibilities such as scientific directors and deputy scientific directors.

The DDIR should establish a scheme for assuring equitable representation of the various institutes on the committee. The committee should include experts from all of the scientific disciplines represented by the faculties, and it should include women and members of underrepresented minorities.

Membership on the Tenure Committee should be for a term of three years, renewable for one term. Initial appointments should be for staggered terms of one, two, and three years so that approximately one third of the membership is rotating off the committee each year.

Once the NIH Tenure Committee is in place, it should no longer be necessary for the Board of Scientific Directors to approve tenure decisions.

POSTDOCTORAL TRAINING

Quality of Postdoctoral Fellows

The scientific staff of the NIH IRP consist of tenured scientists, tenure-track scientists and non-tenured scientists. Postdoctoral trainees are defined as non-tenured scientists who are within five years of their doctoral degree. The size of the training program within each institute and research program varies and is determined by considerations of science, budget, space, and congressional mandates. The IRP training program is a considerable investment: Training stipends for Ph.D.s alone represent an annual $120 million dollar expenditure of IRP funds.

The IRP has played an important role in postdoctoral training, particularly of physician scientists, and has been a source of new scientists for many extramural institutions. It is estimated that some 50,000 scientists have trained at NIH. Today the IRP is one of the largest trainers of postdoctoral fellows in the United States, with 2,351 fellows. This number represents about 15 percent of NIH-funded postdoctoral fellows in the entire scientific community. Upon leaving NIH, postdoctoral trainees have made valuable contributions not only in academic institutions, but also in the development and success of the biotechnology industry.

The success of the IRP depends on postdoctoral trainees, who constitute 50 percent of the NIH intramural scientific work force. Trainees help plan experimental strategies, carry out experimental protocols, interpret research results, and publish research findings. They also provide the most important pool from which scientists are recruited to permanent, tenured positions in the IRP. About 70 percent (146/206) of the tenured appointments made in the past five years were drawn from the non-tenured scientific staff of the IRP. Although the recent creation of the tenure track may facilitate recruitment from outside of NIH, it appears that the majority of individuals appointed to the current permanent staff first arrived at NIH as postdoctoral fellows. The quality of the postdoctoral fellows is therefore an important determinant of the quality of the entire IRP.

Salaries for NIH Ph.D. postdoctoral fellows are very competitive. The starting salary for Ph.D. postdoctoral fellows within the IRP is $25,000 to $30,000. In comparison, stipends for individual or institutional trainees under the National Research Service Awards begin at $18,000 and cannot be supplemented with funds from other federal sources, i.e. federal grants. This large salary differential should provide a selective recruiting advantage for attracting outstanding trainees to NIH, particularly Ph.D.s. But it also creates a potential problem.

Guaranteed internal funding for postdoctoral fellows during previous years may have affected the acceptance rate and hence the quality of postdoctoral fellows. This is further compounded because there are now mechanisms in place to allow non-tenured postdoctoral fellows to remain at NIH for up to eight years. The fates of these individuals pose a significant human resource issue for the IRP. When these individuals remain in the IRP too long, their own opportunities for further training and for career advancement diminish, and they might become a financial burden to the IRP, potentially precluding recruitment of new postdoctoral fellows.

Based upon indirect evidence, in 1992 the *Report of the Task Force on the Intramural Research Program of the National Institutes of Health*[1] concluded that the overall quality of postdoctoral fellows in the IRP had declined over previous years. There is reason to believe this conclusion. The number of postdoctoral fellows in the IRP has increased significantly over the past five years, but the postdoctoral applicant pool has probably not increased to the same extent during this same period of time.

An Advisory Committee to the Director of NIH, convened in 1989, found that there were no centralized data systems—with the exception of medical staff fellowships—that allowed it to compare the quality of the 1989 cohort of postdoctoral fellows with those from earlier years, nor was there a means of measuring the extent to which the intramural program was having difficulty recruiting the best candidates. Because the application procedure for the medical staff fellowships (the major source of physician scientists) was centralized, some data about this group were available. It was noted that there had been a precipitous drop in the number of applications submitted between 1986 and 1988. While similar data were not available for Ph.D.s , the perception was that the number of applicants to that program had also declined.

In an effort to reverse this trend, in mid-1990 the NIH Office of Education was established within the Office of Intramural Research and was given centralized responsibilities in the areas of recruitment, education, and training. The primary goal of the Office of Education is to increase the visibility of IRP training programs and to make them more accessible and understandable to prospective fellows. As a result of advertisement of 142 postdoctoral positions in 1992, 2,410 applications were received (the ratio of U.S. to foreign applicants is unknown).[2] Despite these efforts to recruit more broadly, the issue of quality of trainees remains unresolved.

There still does not appear to be a coordinated effort to evaluate the quality of training programs at NIH. There is no data base to readily assess the success of individuals who have completed training in the IRP, in terms of such variables as number of years in training, number and quality of publications directly related to the NIH training experience, type of appointments obtained after leaving NIH, success in obtaining independent grant support, number receiving tenure in academic institutions, and achievement of national and international recognition. Without follow-up data and without more data on the quality of the applicant pool of entering postdoctoral Ph.D. fellows, the External Advisory Committee is hesitant to comment further upon the quality of the current IRP training programs.

The example of one successful IRP laboratory may serve to emphasize the importance of viewing postdoctoral fellowships as temporary employment. This laboratory recently employed several superb fellows, but only one was offered a tenured position because of perceived overlap with ongoing programs. The future independence of the trainee was a major consideration as well as the enrichment of the IRP. The unlikelihood of promotion was made clear to each of the fellows before they accepted positions at the NIH. Funds saved by terminating postdoctoral fellows in a timely manner were used to recruit a tenure-track scientist from the outside. Excellent start-up packages including 450 to 900 square feet of space, funds to purchase all necessary equipment, an independent operating budget, and commitment of funds for technical support and postdoctoral fellows were made available through the recruitment.

Ethnic and Gender Diversity of Postdoctoral Trainees

The current ethnic diversity of the post-doctoral fellows should be improved. In 1992, only 5 percent were underrepresented minorities. The major barrier to recruitment of underrepresented minorities within the IRP and also in the extramural scientific community can be ascribed to the "pipeline" problem. In 1992 there were 4,672 U.S. citizens who received Ph.D.s in the life sciences. Of this total, African Americans received 86, mainland Puerto Ricans received 36, Mexican Americans received 30, and Native Americans received 20.

With regard to non-physician trainees, over the course of the 1980s there has been little change in the number of independent underrepresented minority scientists resulting from recruitment at the pre- and postdoctoral levels, suggesting that the key to increasing the number of minority scientists lies much earlier than the predoctoral years. To the extent possible, the IRP should broaden its focus to encourage greater minority participation at earlier ages. In 1992, underrepresented minorities received 8.3 percent of all M.D. degrees awarded and, therefore, represent a larger pool among M.D.s than Ph.D.s. Of M.D.s awarded in 1992, African Americans received 850, mainland Puerto Ricans received 101, Mexican Americans received 259, and Native Americans received 63.

A recently proposed approach to achieving the goal of increasing the number of underrepresented minorities who are physician scientists—the Physician-Investigator Preparatory Program—appears to be an excellent approach.[3] The basis of this approach is to provide research experiences for minority medical students during medical school and also to reduce the cost of medical school for those wishing to pursue a research career. It would also expand the pool of minority postdoctoral candidates that might be recruited to the IRP.

Improving linkage with the NIH Minority Access to Research Careers and Minority Biomedical Research Support undergraduate programs and with the Short-Term Training Program for physicians could expand, recruit, and hopefully retain far greater numbers of underrepresented minorities in the biomedical research community than is currently observed nationally and in the IRP.

In 1992, 36 percent of postdoctoral trainees in the IRP were female. The number of women receiving Ph.D.s in the life sciences has increased dramatically in the last 20 years from a few percent to 39 percent in 1992, and the number continues to rise.[4] Women trainees within the IRP disproportionately are faced with career advancement problems associated with other workplace issues, such as family leave and flexible scheduling. The IRP could encourage greater participation of women by endowing its programs with the maximum flexibility possible, and by implementing formal policies for family leave and part-time training. Such policies, moreover, are likely to improve the training environment for all trainees. Once in the IRP, effective mentoring programs

should be in place to enhance retainment and career development of minority and women trainees.

Career Advancement

A number of initiatives have been taken by the NIH Office of Education to improve the training experience of NIH postdoctoral fellows, including lectures on career development, grant-writing workshops, a fellows seminar series, and the establishment of an NIH Fellows Committee with representatives from the basic and clinical sciences in each of the ICDs offering training. These efforts are to be commended.

Broad training should be encouraged in addition to rigorous focused work on a single project. This is crucial if the trainee is to have the greatest range of flexibility as an independent scientist to make original contributions to his or her field. Every effort should be made to develop training programs which cross disciplines and promote interfaces between categorical institutes. Increased emphasis on multi-institutional consortia offers the opportunity to strengthen the quality and expand the diversity of research training environments. In this regard, establishment of more scientific interest groups such as those recently formed in structural biology, cell biology, neurobiology, and genetics, should be encouraged. In addition, the training programs of the IRP would be enhanced by more outreach to the extramural community.

Effective mentoring must be established in all laboratories. Concerns raised about the effective use of postdoctoral fellows and the nature of their training experience cannot be generalized. The functioning and experience of a postdoctoral fellow is determined within the individual laboratory by the quality of the research program and the dedication of the mentor. The quality of a scientist's mentoring should be considered in the evaluation process for promotion and tenure as well as program review. While this is already taking place within some institutes, it is not clear that it is a requirement for all laboratory directors.

RECOMMENDATIONS

1. **The External Advisory Committee supports the concept that the best way to ensure the quality of trainees is to maintain the high quality of the training faculty.**

2. **To identify the most outstanding postdoctoral candidates, intramural training programs should draw from a diverse, well qualified applicant pool.**

Particular attention should be given to recruitment of women and underrepresented minority fellows.

To recruit the best physician-scientist trainees, NIH should investigate the possibility of establishing a two-year National Health Service Program, which would permit graduates of medical schools an opportunity to pay back their loans through service as postdoctoral fellows.

A Distinguished Scholars Program should be established to facilitate recruitment of the best postdoctoral fellows.

Selected trainees should be actively recruited. For example, students in the extramural community supported on individual National Research Service Awards, National Science Foundation predoctoral fellowships, or Howard Hughes Medical Institute Predoctoral Awards and Predoctoral Research Fellowships for Physicians have already demonstrated their exceptional potential. They serve as an excellent predefined pool from which to recruit postdoctoral fellows.

3. **To improve the quality of postdoctoral fellows the availability of postdoctoral positions should be advertised widely. Objective criteria by which to judge applicants should be formulated, and should include publication record and research presentations. Oversight committees within institutes or research faculties should approve selections.**

4. **To improve the intramural training program, the independence and career development of trainees should be emphasized.**

Trainees should be encouraged to seek positions outside NIH following a two- to four-year program so as to continuously provide space and resources for recruitment of new trainees. To ensure that the quality of the training experience is not eroded, special programs, seminars, and workshops should be continually developed to meet the needs of postdoctoral fellows. In addition, grants workshops such as those sponsored by the National Institute of General Medical Sciences should be expand-

ed to assist fellows in establishing their future research independence.

5. **To provide ethnic diversity in the intramural training programs there should be better linkage with the NIH Minority Access to Research Careers and Minority Biomedical Research Support under graduate programs, and with the Short-Term Training Program for physicians. The intramural program should also increase the number of underrepresented minority groups among physician scientists by increasing research experiences for minority medical students.**

6. **To ensure that intramural training programs are of the highest quality, there must be ongoing rigorous assessment of all training activities.**

NIH should undertake a thorough, comprehensive evaluation of its intramural training programs. The External Advisory Committee strongly recommends that an electronic database be developed so that the quality of incoming fellows (M.D.s, D.M.D.s, and Ph.D.s) can be evaluated and continually monitored. Statistics on entering fellows should include prior research training, publication record, grades, educational institutions attended, and results of standardized tests and/or national board scores. To determine efficacy of training within the IRP, a ten-year tracking system should be developed similar to that required of T32 NIH extramural training programs. Data should be obtained not only for M.D.s but also Ph.Ds.

Notes

1 *Report of the Task Force on the Intramural Research Program of the National Institutes of Health,* transmitted April 13, 1992 to Dr. Bernadine Healy, Director, National Institutes of Health, from Richard D. Klausner, Ph.D., Chief, Cell Biology and Metabolism Branch, National Institute of Child Health and Human Development, NIH.

2 In 1992, more than 50 percent of IRP postdoctoral trainees were foreign.

3 Henry Frierson and James Wyche, "Increasing Minority Biomedical Scientists Through The Physician-Scientist Route," *The Journal of NIH Research* 6(2):16-23, February 1994.

4 Of the Ph.D.s awarded in 1992 to underrepresented minorities, minority women received 49 percent of such awards in the life sciences. Over half of the underrepresented M.D. degree-holders in 1992 were women.

ORGANIZATIONAL ISSUES AFFECTING RECRUITMENT AND RETENTION

In its early years, the IRP had an aura of great prestige: positions in it were considered so desirable that the NIH had its pick of the best scientists in the Nation to carry out its mission of basic and clinical research. Many of these scientists then moved on to other institutions, establishing their own programs and becoming strong scientific competitors with the IRP. At the same time, the IRP was perceived to age and to become less attractive. As a result, it is now experiencing difficulties in recruitment and retention of senior scientists. The External Advisory Committee examined the causes of and potential remedies for this loss of competitiveness and its recommendations are consistent with the administrative mandate to "reinvent government."

Scientists initially are attracted to the NIH IRP because of the high quality of scientific colleagues and mentors and by the opportunity to commit full time to research without substantial obligations to non-research related teaching, patient care, and administration. The availability of stable research funding based on retrospective rather than prospective review is particularly attractive to those who desire an opportunity to explore new ideas in their earliest stages. In addition, the resources of the Clinical Center and the opportunity to conduct clinical research, as well as the prospect of interacting with outstanding scientists, add to the attractiveness of the intramural environment.

Many of the organizational complaints about the intramural program focus on personnel issues, including compensation and administrative barriers to a productive work environment. These issues are not new or unique to NIH, but are particularly troublesome where intellectual capital and scientific discovery are the mainstay and mission of the agency. Although recent attention has focused on the loss of several senior scientists from the IRP to other research institutions, it is far more remarkable that many other senior scientists remain at NIH despite burdensome bureaucracy and sometimes noncompetitive salaries.

Personnel

Salaries in the IRP have not kept up with salaries in extramural institutions, particularly for senior scientists and for physicians. Legislation has been passed allowing NIH to pay higher salaries for selected positions under Title 38, but NIH has not been allowed to implement that legislation. The legislation creates a Senior Biomedical Research Service (SBRS), intended to provide supplemental pay up to 110 percent of Executive Level I. Other avenues for employment of high level specialists—such as the Senior Executive Service (SES), Senior Scientific Service (SSS)—either have not been implemented or have been closed to further accrual. In addition, the approval process for all of these higher level positions takes too long and does not serve the purposes of a rigorous recruitment system.

The ability to recruit and retain junior and senior scientists and clinicians as well as talented support staff depends on a flexible pay and personnel system, free of undue complexity. NIH's current personnel system encompasses a multitude of hiring mechanisms, including PHS Commissioned Corps, SES/SSS, civil service, service fellowships, visiting fellowships, intramural research training awards, visiting associates, and visiting scientists. The complexity of hiring due to these varied mechanisms and the lack of broad personnel pay authority at NIH has often resulted in delays in hiring and loss of critical staff necessary to maintain a high quality research environment. Juggling these various personnel systems to staff the IRP with the best scientists available tests the skills of scientific directors and laboratory and branch chiefs.

Another barrier to recruitment and retention is the current federal retirement system. Many academic scientists are covered by systems under which retirement funds can be transferred from one institution to another. If portable retirement systems were available to intramural scientists, one barrier to recruitment would be removed, especially for mid-career individuals. It would also make it more attractive for mid- or late-career intramural scientists to seek other employment if their enthusiasm for research had diminished, and it would facilitate turnover within the IRP.

Scientists at universities have varied sources of temporary technical help which permit labor-intensive research. In contrast, technical assistance in the IRP is vanishingly small because technicians and laboratory assistants take up FTE slots that could be used for professionals. As a result, IRP scientists and their postdoctoral fellows spend time on tasks best performed by less skilled personnel, or contract for these tasks to be done by commercial organi-

zations at considerable cost. Neither approach is a wise use of valuable resources. The IRP should consider establishing some mechanism for employing technical assistants for short periods (e.g., up to three years) in untenured positions.

A major problem regarding personnel policy has arisen from the designation of the IRP as an administrative expense, and the resulting designation of scientists at the level of GS-14 and above—as well as their counterparts in the Commissioned Corps—as "managers" whose numbers must be drastically reduced under an executive mandate to reduce the size of the bureaucracy. In the IRP, the ranks of GS-14 and up are given to scientists with high technical skills in order to provide a salary that is appropriate to their professional standing. A GS-14 scientist is likely to have a small laboratory with a couple of postdoctoral fellows and technicians and responsibilities that correspond roughly to those of an associate professor at a university—far from the duties of a middle manager of an administrative office. The depletion of positions at the level of GS-14 and GS-15 will make it difficult to recruit, tenure, and promote talented young scientists for years to come. It is difficult to see how the IRP can hope to revitalize itself under these circumstances. Treating NIH bench scientists as equivalent to administrative members of the civil service results in actions instituted across the service irrespective of the actual job description.

The External Advisory Committee strongly opposes the recent decision to classify the IRP as an administrative expense. To designate the intramural programs as "administrative" could ultimately be destructive to the mission of NIH in that it makes it difficult, or impossible, to implement the recommendations related to assuring the quality of IRP personnel and projects detailed in this report. All efforts should be made to exempt the IRP from an administrative classification.

Procurement

The procurement process for the IRP is repeatedly cited as burdensome to the conduct of research. The ability to purchase efficiently—both in terms of cost and time—research supplies, equipment, and services is critical to a successful and competitive research enterprise. The complex procurement process often requires that scientists prepare lengthy justifications for purchases that must then go through prolonged clearance reviews. Current procurement policies and procedures require extensive documentation for the most simple purchase. For example, the policy requiring lists of alternative sources does not necessarily result in savings. In addition, many items could be purchased at less expense and with faster delivery from sources other than those required by the procurement system.

While it is clear that many of the procurement rules are targeted at saving federal dollars through competition, the impact of increased administrative oversight and increased paper work and delays in receiving materials result in lost research time by scientific staff and the cost of this reduction in productivity offsets procurement savings. This situation also can result in an increasing ratio of infrastructure to scientific personnel. Under current regulations, purchasing personnel must be distanced from the scientists placing the orders and communication between them must be limited. Designed to protect the government agency from appearing to favor one supplier over another, this distancing has resulted in deterioration of services from purchasing offices, which are considered slow and unresponsive. While acquisition of large equipment often is delayed pending availability of funds, such unavoidable delays often are aggravated by the slow processing of the orders. The situation is at its worst in the purchase of computer equipment, which must undergo additional layers of administrative approval.

The regulations governing procurement should be reexamined in the light of "reinventing government." The Vice President has directed a rewrite of the Federal Acquisition Regulations as part of the National Performance Review. It is expected that, if implemented, revisions in the procurement process would provide a welcome relief in the IRP. The NIH intramural program could serve as a model for developing and testing novel procedures to make the procurement process fast, efficient and responsive to research needs, while maintaining a high level of protection for the integrity of federal spending.

Laboratory Space

It has been felt for many years that many of the laboratory physical facilities at NIH are in poor condition. Modern safety requirements and constantly changing technologies further compromise the already decaying infrastructure (see the later discussion on the renewal of the Clinical Center). Overcrowding in less than modern facilities contributes to low morale and less than desirable productivity. Long delays in the renovation of office and laboratory space contributes to the uncertainty of research planning.

Most extramural visitors are shocked at the cramped quarters in which IRP staff must work. Many institutes report less than 250 square feet of net usable space per professional scientist, including common space for libraries, conference rooms, instrument rooms and cold rooms. This is substantially less than the space generally available in the extramural community. It would be fiscally impossible and scientifically undesirable to build enough space to accommodate all the activities that now

take place in the overcrowded IRP. More rigorous review, with prompt reduction or elimination of space for unproductive groups should help to generate space that would become available for distribution to the more productive scientists.

Specialized Facilities

Modern biomedical research increasingly depends on the availability of large and costly instruments that require experts for their operation. Major research universities maintain centers that service the needs of biomedical scientists for such procedures as peptide synthesis, protein sequencing, DNA sequencing, fluorescence activated cell sorting, and sophisticated microscopy. Most NIH intramural scientists are hampered by the lack of such facilities, although some institutes have their own. Institutes must either divert precious financial and personnel resources to operate their own, depend on the good will of colleagues who have such facilities, or obtain these services from commercial organizations. The External Advisory Committee urges that scientific directors organize institute-wide facilities.

The Committee notes that the situation is very different with respect to computer resources. The NIH Computer Center, for example, has for many years consistently provided up-to-date equipment, software, training and advice to IRP scientists, and could serve as a model for other such NIH-wide ventures.

Professional Interactions

One of the attractions of the IRP environment has been an "academic atmosphere," which includes free and open association with colleagues both inside and outside NIH. An increase in restrictions and regulations regarding travel budgets and outside activities severely compromise opportunities for intramural scientists to interact with their colleagues from other research institutions. Scientists report that they are discouraged—sometimes prevented—from taking part in affairs of professional societies and even from collaborating with extramural scientists. This differs among institutes, reflecting local interpretations of conflict-of-interest issues. A ban on honoraria for lectures clearly sets intramural scientists apart from their academic peers; it is considered by IRP scientists to be irrational since consulting is permitted.

Severe limitation on travel to scientific meetings increases the sense that IRP scientists are isolated from their peers in the extramural community; it is particularly damaging to young scientists who cannot afford to go at their own expense. Travel to scientific meetings should be viewed as a necessary and integral part of research.

RECOMMENDATIONS

1. **Recognizing that it is not within the authority of the Director of NIH to change the current classification of the intramural research program as an administrative expense, the Committee is strongly of the opinion that it should not be classified in this manner.**

Such a classification leads to budgetary procedures which are not rationally related to the scientific process and do not support the goal of achieving the highest quality and productivity in the intramural research program. This approach is inappropriate and counterproductive to recruiting, providing tenure, and retaining the highest quality research personnel. All efforts should be made to exempt intramural scientists from this classification.

2. **The Deputy Director for Intramural Research should establish a joint committee of IRP scientists and NIH administrators to review regulations and restrictions that isolate intramural scientists from their colleagues in the extramural community and to propose appropriate modifications.**

3. **NIH should be granted by the Department of Health and Human Services (DHHS) the authority, through the Senior Biomedical Research Service, to implement all actions necessary to recruit, hire, and pay scientists in a timely and appropriate manner.**

4. **NIH should be permitted to provide portable retirement systems to intramural scientists to remove a major barrier to recruitment, especially for mid-career individuals.**

Providing such systems would also make it more attractive for mid- or late-career IRP scientists to seek other employment if their enthusiasm for research had diminished and would facilitate turnover within the IRP.

5. **In the context of "reinventing government," opportunities exist to dramatically improve the flexibility in procurement procedures, appointment of staff, and allocation and use of laboratory space and research resources.**

NIH could serve as a model for developing and testing novel procedures to make the procurement process fast, efficient and responsive to research needs, while maintaining a high level of protection for the integrity of federal spending.

NIH-PRIVATE SECTOR COLLABORATIONS

Not infrequently intramural scientists at NIH perform basic or clinical research which can lead to the formulation of a biological material, drug, or device that can then be developed commercially. The process by which the results of this research are applied to health care is technology transfer.

More generally, technology transfer is the process by which results of research and development are applied and utilized in another area, organization, or commercial sector. The term can refer to the legal and administrative process by which the transfer of legal rights—such as the assignment of title to a patent to a contractor, or the licensing of a government-owned patent to a company—is achieved. Or, it can refer to the informal movement of information, knowledge and skill from a Federal laboratory to the private sector through person to person contact. The most crucial aspect of technology transfer, however, is the use of product- or process- technology in a new enterprise.

The Federal Technology Transfer Act of 1986 sought to promote technology transfer by authorizing government-operated laboratories, such as the NIH IRP, to enter into Cooperative Research and Development Agreements, better known as CRADAs,[1] with other federal agencies, state or local governments, and industrial and non-profit organizations. This law authorizes the Director of NIH to negotiate licensing agreements for government-owned inventions created in the IRP and for other inventions of NIH employees that may be voluntarily assigned to the Government. This provision allows inventors and laboratories to keep a percentage of any royalties paid on these licenses.

The wave of legislative and executive initiatives in technology transfer that swept the U.S. research enterprise in the 1980s continues to be evaluated. Although the number of CRADAs has increased over time at all agencies, the qualitative value of such agreements has not been fully assessed. Clearly the system is now more open and inviting to the private sector than it was before 1980, but recent analyses show that significant barriers remain on both sides of the technology transfer equation.

Recent congressional scrutiny of pharmaceutical industry research agreements with NIH laboratories and NIH-funded laboratories has focused on issues of patent ownership, drug pricing, and concern that academic-industry agreements may involve exclusive access to NIH-funded research. These concerns have led to inspection of the contract provisions in CRADAs as well as other types of research arrangements between NIH and the pharmaceutical industry. Increased attention on pharmaceutical price controls has also resulted in a "reasonable pricing" clause in all types of research arrangements between NIH and the pharmaceutical industry, including large NIH-initiated clinical studies of approved and marketed products.

It is important that the true purpose and scope of the CRADA as originally intended by the Federal Technology Transfer Act be followed by NIH and respected by industry; otherwise the goals of technology transfer are at risk. A CRADA is a formal mechanism by which relevant basic research knowledge is transferred to a commercial entity with the capacity and resources to utilize that information in the development of new drugs, preventives or diagnostics. The transfer of information is a collaborative research process characterized by an extensive two-way intellectual interchange and contributions toward a defined research workplan.

A CRADA should not be a mechanism to fund basic research in NIH laboratories nor should it be a mechanism by which NIH competes with the private sector. The mission of NIH is best served by conducting research in the laboratory and in the clinic. The return on federal investment in NIH research should not be judged on the amount of revenue the NIH laboratories generate.

1 As defined by the Federal Technology Transfer Act of 1986, a CRADA is any agreement between one or more federal laboratories and one or more non-federal parties under which the Government provides personnel, services, facilities, equipment, or other resources (but not funds) and the non-federal parties provide funds, personnel, services, facilities, equipment, or other resources toward the conduct of specific research or development efforts.

The CRADA Process: Information, Review, Approval and Implementation

A recent report from the Office of Inspector General of the Department of Health and Human Services identified several issues that have limited the utility and productivity of the CRADA system, particularly at NIH where the number of new CRADAs signed annually since 1988 has never exceeded 50 (compared to nearly 300 in 1993 at the U.S. Department of Energy) and where the average approval time is now 10 months (compared to less than two months at the National Institute for Science and Technology). The report concluded that while the NIH's inclusion of a "reasonable pricing" clause in CRADAs was a major factor in dampening the pharmaceutical industry's interest in this mechanism of technology transfer, the other major impediments to a more successful CRADA program concerned process issues: inappropriate selection of research projects for CRADAs, the lengthy and complex procedures to establish a CRADA, inadequate advertising of CRADA opportunities, the absence of a central database to track CRADAs, and limited NIH oversight of the process.

Advertising of CRADA and Other Licensing Opportunities

The Inspector General noted that the NIH procedures for dissemination of information about CRADA opportunities or the CRADA process do not provide adequate "fair access" to such information for potential commercial partners and that limited and select distribution or access to CRADA opportunities could undermine the industry's interest in the CRADA system, impede market competition, and erode public support.

PHS does publish an annual Technology Transfer Directory that lists CRADA opportunities and other research tools or inventions available for exclusive or non-exclusive licensure, and organizes periodic technology transfer workshops where NIH scientists present research projects that are available for cooperative agreements or other licensure. However, the PHS directory is of limited utility since projects are merely "listed"—150 pages of abstract after abstract—and not well-organized in terms of either therapeutic or research tool categories. The directory does have sections on existing CRADAs and model CRADAs with boilerplate language, but does not fully explain the purpose, expectations and responsibilities of the respective collaborating parties.

Establishment of a CRADA—Review and Approval

The review and approval of a CRADA at NIH is a time-consuming, cumbersome and unnecessarily complex process. The process requires scientific, policy, legal, commercial and administrative review.

At the laboratory level, the NIH investigator and the proposed collaborator, in conjunction with the institute's technology development coordinator, develop a CRADA based on a research plan. The institute's coordinator orchestrates the entire review process of each CRADA and serves as advisor to the NIH investigator. The CRADA must then be approved by the laboratory/branch chief as well as the coordinator.

At the institute level, the CRADA is reviewed by the scientific director for scientific merit, consistency with the institute's research mission, allocation of financial and staff support, and conformity of intellectual property contributions with NIH CRADA policy. The institute's ethics officer reviews the CRADA for potential conflict-of-interest issues.

At the NIH level, the CRADA is reviewed by the Office of the General Counsel, the Office of Technology Transfer, and then the NIH CRADA Subcommittee. If the CRADA does not deviate from the standard CRADA model, it is reviewed by the NIH CRADA Subcommittee but does not need further review.

The CRADA Subcommittee advises the NIH Director on specific CRADAs and CRADA policy. The CRADA Subcommittee is comprised of the NIH senior scientists, institute-level executive officers, the Director of the NIH Office for Technology Transfer, and the NIH General Counsel. The subcommittee's review focuses on the scientific, legal, and administrative policy aspects of the CRADA and its impact on the basic research mission of the NIH laboratory. The CRADAs recommended for approval by the subcommittee are forwarded to the NIH Director for review. CRADAs that are approved by the NIH Director are returned to the institute director for final signature.

Once CRADAs are established, all ongoing CRADA research undergoes periodic peer review within the institutes by the boards of scientific counselors to ensure and maintain the highest quality of research conducted in the intramural research program at the NIH. Review by the BSC is not required for the initial approval of the CRADA.

The average time to establish a CRADA is 250 to 350 days. Clearly this process would benefit if it were streamlined.

Implementation of CRADAs and Cost of Maintaining Patents

The costs of filing patents arising from CRADA research and the costs of maintaining the patents once issued are significant. The question has been asked whether costs could be reduced by changes within NIH in reviewing which patents to file and in ensuring the expeditious handling of applications.

Access to Research Tools

Licensing of inventions under CRADAs should distinguish commercial use from research use. Licenses for research use should be on a non-exclusive and reasonable basis in order to make research tools broadly available. Exclusive licensing of research tools creates impediments to the advancement of medical science.

Non-Exclusive Licenses for Research Tools

A policy that promotes open and broad access of research tools discovered or created in the NIH laboratories, with the appropriate remuneration to the laboratory under a non-exclusive license, would foster competition among commercial laboratories to discover and ultimately develop human health products, thereby meeting the congressional intent to spur technology transfer that benefits the public health and improves the U.S. position in a global economy. Exclusive licensing of government inventions for the commercialization of products and processes under a CRADA is necessary to encourage cooperative research between NIH and commercial entities, but such inventions should be licensed on a non-exclusive basis for research use. Through non-exclusive licenses, and for reasonable fees, the NIH should strive for rapid notification, evaluation and licensure to academic and commercial laboratories on a broad basis.

Procedural Problems In Acquiring Research Tools

In addition to promoting a policy of non-exclusive licensure of research tools for research purposes, the NIH also should enhance the speed and efficiency of the process of granting non-exclusive licenses. The procedures to procure cell lines or clones from NIH on a non-exclusive license basis are bureaucratic and cumbersome. Such procedures do more to block the transfer of basic research tools than to facilitate such transfer, ultimately delaying the research process.

Reasonable Pricing Clauses within CRADAs

The report from the DHHS Office of Inspector General acknowledges that Congress did not address the issue of pricing in the Federal Technology Transfer Act. NIH has incorporated a reasonable pricing clause within its model CRADA. Several pharmaceutical companies have refused to participate in CRADAs due to the reasonable pricing clause and some have convinced NIH to modify or limit the clause in their CRADAs. Such clauses discourage technology transfer and the development of new therapeutic products by imposing pricing restrictions that may limit the ability of a company to recover its costs of research and development. Royalty provisions or payments to reimburse the government laboratory for its costs or, in appropriate circumstances, the supply of clinical materials (rather than restrictions on the pricing of products) may be more appropriate mechanisms to fairly and appropriately compensate the government laboratory for the use of its technology in commercial development.

RECOMMENDATIONS

1. **To ensure that the NIH intramural program is fulfilling its mandate to facilitate technology transfer NIH should broadly communicate in a clear and precise manner the scope, purpose and definition of a Cooperative Research and Development Agreement.**

2. **NIH should create a readily accessible centralized database which contains CRADA and other licensing opportunities throughout all the institutes.**

3. **NIH should develop and publish a practical guide that explains both the substance and process of CRADAs and other licensing opportunities at NIH and further, should develop a mechanism to assure broad dissemination of the guide to the relevant commercial audiences.**

4. **NIH should be more accountable for the timely and efficient review and approval of CRADAs.**

With the establishment of a centralized database to track the development and review of a CRADA, much of the review could be completed electronically. NIH should consider conducting the various layers of review in parallel rather than sequentially to shorten the approval process.

5. **NIH should fully promote and utilize the "Letter of Intent" CRADA, introduced in 1993, which only takes a few weeks to prepare and allows collaborative research work to begin rapidly.**

Any invention made prior to the implementation of the full CRADA is retroactive and the parties' intellectual property rights are protected.

6. **NIH should continue plans to implement an improved system to manage and track the filing of patent applications, and develop training programs for NIH staff to improve the quality of the applications and the efficiency of the process.**

Where patent rights are exclusively licensed to a commercial collaborator under a CRADA or other research agreement, the commercial partner should bear the cost of patent filings (or at least contribute in part).

7. **NIH should develop and implement a clear statement of policy that promotes the non-exclusive licensure of basic research tools to academic and commercial laboratories for research purposes.**

When non-exclusive licenses for research tools are granted, a pro rata sharing of patent filing costs among all commercial licensees may be appropriate.

8. **NIH should examine its procedures for handling requests for non-exclusive licensure of basic research tools for research purposes to assure that the process facilitates rapid and broad access to research tools to enhance, not impede, both biomedical research in academic and industrial laboratories and subsequent commercial development of important technologies to improve human health.**

9. **The NIH CRADA Subcommittee should periodically conduct a comprehensive review of all existing CRADAs that have been established to determine whether: 1) truly useful technology transfer that will benefit public health has resulted from the CRADA system; 2) the CRADA system has been an efficient use of both government and private resources in transferring new technologies; and 3) the CRADA system has had an adverse impact on the basic research mission or funding of laboratories that have participated in CRADA projects as well as those that have not participated.**

10. **Considering the controversy over the inclusion of reasonable pricing clauses in CRADAs, NIH should convene a public meeting with all interested parties and constituencies from the public and private sectors to specifically address resolution of this issue.**

nity has expanded at a more rapid rate than the IRP. Questions also have been raised about whether some of the research conducted in the IRP could be done equally as well in the extramural program, reserving for the IRP those research activities that can be more readily and effectively pursued intramurally. These are complex and significant questions, particularly in the face of sometimes competing goals of deficit reduction and the acquisition of new knowledge. The issue of whether the allocation of resources between the IRP and ERP is balanced and appropriate is made all the more important by virtue of the concerns in the extramural community regarding availability of NIH funding, particularly for young investigators.

At the present time, the Committee could discern no consistent policy for all ICDs for allocating resources between the intramural and extramural programs. Most ICDs use a variety of mechanisms including external advisory committees, internal committees, Congressional directives, and less formal mechanisms to set scientific priorities and resource allocations. A few institutes, such as the National Institute for Allergy and Infectious Diseases, have well-articulated procedures based on active planning processes for making allocation decisions in a prospective manner. Such planning processes consider the most rational and cost effective intramural component to carry out new or existing projects.

In other cases, institutes appear to have maintained the same rate of growth in their intramural programs as for the total institute budget without employing a rigorous process of determining research priorities. Thus, historical distribution of funds becomes in part a rationale for current decisions.

The External Advisory Committee believes that the allocation of resources between the intramural and extramural programs must be conducted on an institute-by-institute basis because of: 1) the differing missions of each ICD; 2) changing opportunities and needs; 3) available skills, expertise, and resources required to address particular scientific problems; and 4) changing research resources in the IRP and ERP.

While the Committee believes that the NIH planning process should be sufficiently flexible to accommodate specific needs of individual ICDs, certain minimal standards applied across all ICDs are essential. The Committee strongly recommends that a formal, written process for allocating resources between the extramural and intramural programs be established for all of NIH; a model for such a process might be that used by NIAID. In doing so, a critical principle must be emphasized; that of maximizing the use of scarce resources in solving problems in health and health sciences. Because institute budgets are appropriated by Congress without regard to the extramural/intramural allocations it is incumbent on NIH to extend its own oversight of this process.

In addition, any decision to shift funds between the intramural and the extramural programs must reflect the more judicious use of funds in support of biomedical discovery and the public's potential benefit. The process of resource allocation, in the final analysis, should be based on judgement by the best available experts in the particular area of biomedical research. Such expertise should be drawn from both the intramural and extramural communities.

The Committee believes that the public, Congress, and the scientific community can be best assured that the allocation of resources between the extramural and intramural programs is appropriate if there is full and open consideration of these decisions by the intramural leadership in cooperation with representatives of the extramural community. Institute and scientific directors must exhibit leadership and identify promising areas of research for either the intramural or the extramural program. The Committee believes that a more open process will strengthen the outcome of research investment without in any way interfering with the leadership of the intramural scientific community.

The Committee emphasizes the severe difficulties posed in making allocation decisions by the recent decision by the Office of Management and Budget, congressional appropriations committees, and DHHS to classify the NIH intramural research program as an "administrative expense," rather than as a "program of research," similar to the extramural research program. This decision is counter to an agreement reached several years ago by NIH, the congressional General Accounting Office and the House Energy and Commerce Committee to classify the IRP as a "program of research." The classification of the IRP as administrative subjects it to an Executive Order to reduce "supervisory" personnel, a classification which would be assigned to working scientists without significant supervisory responsibilities.

The External Advisory Committee strongly opposes the decision to classify the IRP as an administrative expense. This approach is inappropriate and counterproductive. The Committee suggests that a more appropriate mechanism for improving the cost-effectiveness of the IRP is through thorough quality review rather than across-the-board reductions. If the overall NIH scientific mission is to be assessed and allocation decisions are to be made on the basis of scientific excellence and opportunity, then identifying a portion of the research mission as "administrative" is artificial and misleading, and leads to budgetary procedures which are not rationally related to the

scientific process and do not support the goal of achieving the highest quality and productivity of the IRP. The intramural and extramural programs should be considered integrated and complementary investments in improving the Nation's health. To designate the intramural programs as "administrative" could ultimately be destructive to the mission of NIH in that it makes it difficult, or impossible, to implement the recommendations related to assuring the quality of IRP personnel and projects detailed in this report.

What should be the ultimate outcome in terms of balance of intramural and extramural programs? A more rigorous review of quality is likely to produce restructuring of the current intramural program. Low priority programs should be reduced or terminated. High priority programs may benefit from increased resources. In the current fiscal climate it is unlikely that there will be a substantial increase in overall resources for the intramural program. Public interest demands that the size of the intramural program be governed by excellence, opportunity, need, and ability to respond quickly to crises, such as that represented by the AIDS pandemic. A thoughtful and well-conducted prospective planning process for determining the intramural allocation, such as that outlined below, will achieve an effective balance.

RECOMMENDATIONS

1. **The intramural/extramural resource distribution should be based on an annual prospective planning process carried out by each ICD.**

The process should be outlined in a written document and reviewed, approved, and monitored by the NIH Director and the Advisory Committee to the Director, NIH. Extensive consultation with the extramural research community should be part of this process. The overall NIH scientific mission should be assessed and allocation decisions made on the basis of scientific excellence and opportunity.

The planning process for each ICD should involve a rigorous review by the BSC of the quality of all of the intramural research activities within that ICD, including a ranking of the relative merit of all intramural programs, comparable to methodologies used in the extramural program. Minimal criteria to be used in considering programs for intramural funding include: a) availability of intramural investigators of outstanding quality; b) special resources or personnel unique to the IRP which are related to specific research objectives; c) the time required for a rapid response to urgent research questions; d) the need of the ICD to maintain a research activity of quality; and e) the requirements for adequate research training of young intramural scientists.

2. **The planning process should include a review of resource allocation for the IRP by a committee chaired by the Director of NIH which includes the Director of the IRP, chairs of the institutes' boards of scientific counselors and, if the Director of NIH deems it desirable, a representative of the Director's Advisory Committee. The results should be communicated to the councils of the appropriate institutes.**

This review should be done in a timely fashion with recommendations regarding resource allocation made to the scientific and institute directors and the NIH Director. Quality assessment and the potential for success of the programs pursued in the IRP should be the primary criteria for these recommendations.

Following this review, each institute director should be responsible for implementing the allocation of intramural and extramural budgets, as is the current practice. In an ongoing review of the intramural budget, the institute director should assess the percent of the budget devoted to personnel, travel, training, supplies, equipment, and contract services.

3. **Annually each institute or center director should provide to the NIH Director projections of intramural compared to extramural funding as well as the specific rationales on which they are based.**

4. **After final appropriation, the NIH Director should be given the discretion to recommend the reallocation of funds based on perceived timely needs and scientific opportunity. This flexibility should not exceed five percent of the IRP budget of any given ICD.**

5. **A criterion used to evaluate the performance of an institute director should be the management of the extramural/intramural allocation process.**

An additional criterion should be the extent to which the director developed formal programs to promote interactions between intramural and extramural scientists. Results of the evaluation, which should occur at least biannually, should be reported in writing.

6. **Each ICD should have in place a formal process to implement the above recommendations in a manner that will allow the NIH Director—with input from the Director's Advisory Committee—to certify immediately, or at least by January 1, 1995, that appropriate procedures and policies are in place.**

7. **In the context of these recommendations, a centralized decisionmaking process governing the total NIH extramural/intramural allocation should ensure that the total intramural research program budget for institutes, centers, and divisions does not exceed the current rate of 11.3 percent of the total NIH budget.**

This percentage should be reviewed through the process outlined in recommendations number 1 and 2 above, following *full implementation* of the recommendations which emerge from the quality review of the intramural program as detailed in this report. It is anticipated that implementation of this process of quality assurance may require 3 to 4 years.

RENEWAL OF THE CLINICAL CENTER

With over 1.3 million square feet, the original Clinical Center complex of NIH opened in 1952 as one of the world's premier biomedical research facilities. Few things distinguish the IRP from the ERP more than the presence of the Clinical Center, with its laboratories, hospital, and outpatient clinics designed to facilitate clinical research (see Table 1). The ability for long-term follow-up of patient populations from across the country, relatively stable funding, and a broad range of laboratory research and support systems have allowed for the development and detailed studies of diagnostics and therapeutics as well as basic clinical research about the causes and courses of disease. A central goal of the work of intramural clinical investigators is the application of basic laboratory advances to clinical application.

The Clinical Center facilities have been the site of many productive, pioneering studies, including some that were congressionally mandated. Such studies include investigations of alpha-1-antitrypsin deficiency, cystic fibrosis, gene therapy for severe combined immunodeficiency and thalassemia, immunotherapeutics in cancer, AIDS therapeutics, bone marrow transplantation, and development of enzyme therapy for Gaucher's disease. The many drugs and diagnostic tests which have been developed as a result of clinical studies conducted in the Clinical Center are evidence of the substantial achievements of the IRP. These include the development of IL-2 and its clinical applications, the AIDS diagnostic test kit, a number of unique monoclonal antibodies, vaccines and gene therapies, anti-AIDS drugs, anti-cancer drugs, and the use of growth factors in bioregulation techniques to improve imaging.

Size and Budget of the Clinical Center Complex

The Ambulatory Care Research Facility, completed in 1980, was the first major addition to the Clinical Center since its construction in 1952. Other additions have occurred over the years and the Clinical Center complex today is approximately 3 million gross square feet (1.8 million net square feet). The complex comprises approximately 40 percent of the total space on the NIH campus and forms the core of the clinical research component of the NIH intramural program.

Of the total IRP FY 1992 budget of approximately $973 million, $305 million was expended for clinical research (approximately 31 percent). The portion of the Clinical Center budget directly related to patient care included an operating budget of about $250 million, including expenditures for collateral support.

The Clinical Center hospital is approximately 31 percent of the Clinical Center complex (just over 1 million gross square feet). Inpatient space represents 34 percent of the hospital (originally designed for 540 beds); outpatient space represents 12 percent of the hospital, or 126,000 gross square feet; core facilities represent about 54 percent of the hospital or 551,000 gross square feet.

Need for Renewal of the Clinical Center Complex

In recent years, it has become clear that the infrastructure of the Clinical Center is deteriorating. A comprehensive study of the infrastructure systems was conducted by an independent engineering firm and reviewed by NIH staff after NIH maintenance personnel reported that major mechanical systems that support both research and patient care would exceed their service life within the next few years and could no longer be properly maintained. In addition, an independent technical evaluation of plans for renewal of the Clinical Center was conducted by the U.S. Army Corps of Engineers as a result of a congressional request. The structural problems identified by these studies include mechanical and electrical deficiencies, the presence of hazardous substances, and physical constraints to renovation.

NIH reports that as a result of this decay research initiatives have been restricted and safety concerns have increased. In addition, intramural scientists complain that there is crowding in laboratories in the Clinical Center.

In the course of this review, members of the External Advisory Committee toured areas of the Clinical Center and saw vivid evidence of deterioration of the infrastructure and laboratories, as well as areas where renovation had restored facilities to an attractive and good working environment, although presumably requiring additional infrastructure upgrading. The decaying infrastructural

core of the Clinical Center supports a majority of the research laboratories as well as all of the inpatient nursing units.

Considerations in the Renewal of the Clinical Center Complex

Over the past three years NIH has evaluated various options for resolution of the Clinical Center's structural deficiencies. Four options for renewal were presented to the External Advisory Committee, ranging from no new construction to total replacement of the existing facilities, with cost estimates between $874 million and $1.2 billion (see discussion below).

In considering the needed size of a renewed Clinical Center inpatient facility, the Committee considered: 1) current protocol activity; 2) the characteristics and quality of active protocols; 3) occupancy rates; 4) trends toward implementation of new protocols in an ambulatory setting; 5) the need for specialized units (e.g., for pediatric protocols, immunosuppressed patients, transplantation protocols); and 6) the relationship of IRP protocols to extramural programs.

In considering the renewal requirements for the Clinical Center research facilities, the Committee also considered: 1) the current conditions of the research facilities; 2) the need for proximity between the patient care and laboratory facilities; and 3) the quality and size of the clinical research program. Issues affecting quality, such as those discussed in previous sections of this report, were an integral part of the evaluation.

In addition to the above considerations, the recommendations found in this report are based on: 1) testimony from scientists, institute directors, scientific directors, Clinical Center staff, and NIH administrative staff; 2) extensive documentation provided to the Committee; 3) invited written comments of members of NIH professional staff; and 4) site visits to the Clinical Center.

Findings of the Committee

Use of Patient Care Facilities

The Clinical Center hospital was originally designed for 540 beds: The available beds in FY 1993 varied from 385 to 417.[1] In evaluating the current operating size of the Clinical Center hospital, the Committee received testimony that the current budget provided staffing for 84,000 patient days or an average daily census of 230 patients. In FY 1993, there were 80,000 patient days with an average length of stay of 9 days. In addition, there were 83,000 outpatient visits.

The Committee received a detailed analysis of the average inpatient occupancy by institute and day of the week in FY 1993. Based on the 422 beds available for most of that year, the highest occupancy rate was approximately 58 percent on any given day, with variability among the institutes. Beginning in FY 1995 the ICDs will pay for space they are assigned whether or not their beds are occupied. The Committee was told that a number of factors have influenced the occupancy rate over time, including a trend toward shorter patient stays and increased utilization of the Ambulatory Care Research Facility for clinical research. On a daily basis additional factors contribute to occupancy, such as the frequent need to limit room occupancy to one patient, and the specialized research and patient care needs of particular institutes. Staffing complements are designed for the number of patient days in the hospital as well as the projected needs of the institutes.

Clinical Research Protocols

Laboratories are physically close to clinical space and training activities emphasize a merging of basic research and conventional clinical skills. The clinical programs involve extensive collaborations among research groups at NIH. As of December 1993, 811 protocols were active in the Clinical Center involving 20,136 patients. Of these protocols, 50 percent are of a therapeutic nature, 35 percent concern the pathogenesis or natural history of a disease, and 15 percent are evaluating new diagnostic procedures. Eighty-five percent of the therapeutic trials are Phase I or II clinical trials.[2] Three institutes are performing phase III or phase IV clinical trials. During FY 1993, 175 new protocols were initiated and approximately the same number were discontinued.

Evaluation of the quality of the clinical research protocols conducted in the Clinical Center was beyond the scope of the Committee's work. Nevertheless, the Committee believed it necessary to obtain an estimate of the quality of protocols underway in order to better judge proposed plans for renewal of the facility. To do this, the ICDs were asked to prioritize their active clinical protocols. Each ICD using the patient facilities of the Clinical Center complied with this request. The Division of Cancer Treatment of the National Cancer Institute—which has the largest number of active protocols—used a scoring scale of 1 to 4 as follows:

1. The very best, unique, innovative trials with strong laboratory support.

2. Good but perhaps not unique protocols.

3. Investigational questions of average importance, generally lacking a laboratory basis and not using any resources unique to the Clinical Center.

4. Protocols representing poor or obsolete ideas.

The criteria used to assign a priority to each active protocol included: 1) alignment with the NIH and Clinical Center missions; 2) the extent to which the protocol represents cutting-edge science; 3) whether the Clinical Center environment is uniquely appropriate for the study; 4) whether the protocol addresses a national public health emergency; 5) the importance of the protocol to training; 6) whether the protocol is crucial to the institute's research program; 7) whether the protocol is likely to contribute to patient care or patient comfort; and 8) whether the protocol attempts to improve the efficiency or cost effectiveness of patient care.

Using these criteria, the Division of Cancer Treatment assigned to approximately 15 percent of all active protocols a priority score of 4, and another 35 percent of the active protocols a priority score of 3. Only about 50 percent of the active protocols were ranked with a priority score of 1 or 2, representing protocols considered good to the very best. The External Advisory Committee felt that only protocols deemed very good to outstanding should be supported by the resources of IRP, given the limited facilities and funding.

Options for Renewal

The Committee was initially presented by NIH with four options for renewal of the Clinical Center. These options were premised on: 1) maintaining the current level of programs; 2) providing a safe and efficient infrastructure system; 3) minimally disrupting patient care programs; and 4) minimally disrupting ongoing research activities within the Clinical Center. The options included:

Option A: New Inpatient Hospital and Laboratories/ Reuse of Existing Laboratories

Option B: Total Replacement Facility

Option C: New Clinical Research Facility/Reuse Existing for Basic Laboratories

Option D: Reuse Existing Facility/No New Construction

After review of each of these options, the Committee concluded that none were adequate and appropriate given the anticipated program requirements and budget constraints. Specifically, the Committee concluded: 1) an inpatient facility smaller than the current size would be adequate for foreseeable future IRP needs; 2) total replacement of the Clinical Center complex was neither necessary nor desirable; and 3) a phased program of renewal would be consonant with a long range strategic plan to implement more rigorous quality assurance for research programs of the IRP.

The External Advisory Committee requested that NIH develop additional options for a modular approach to renewal with greater consideration for containing costs. The following additional options were presented.

Option I: Early stage replacement of 50 percent of the Clinical Center research laboratories, early stage replacement of the hospital to accommodate 300 beds, and acquisition of the Uniformed Services University of Health Sciences facility, including required upgrade and operating costs for that facility.

Option II: Early stage replacement of 50 percent of the Clinical Center research laboratories, early stage replacement of the hospital to accommodate 200 beds, and acquisition of the Uniformed Services University of Health Sciences facility, including required upgrade and operating costs for that facility.

Option III: Early stage replacement of 50 percent of the Clinical Center research laboratories, early stage replacement of the hospital to accommodate 300 beds, and time and cost involved in upgrading existing research laboratories in the Clinical Center.

Conclusions

Upon analysis of the programs of the Clinical Center facility, the External Advisory Committee is strongly of the opinion that the Clinical Center is essential to the intramural research program. The Committee recognizes that a crucial asset of the Clinical Center complex is the flexibility it offers to respond to new opportunities and needs by rapid redirection of resources, such as with research on human immunodeficiency virus, breast cancer, and prostate cancer. Because the Clinical Center is not obligated to provide all types of clinical services, it can more readily redirect resources to new, innovative areas of research. In addition, the existence of a high caliber staff, on-site, with expertise in clinical research, allows for the rapid implementation of new initiatives.

The Committee also recognizes that the Clinical Center, with its appropriate facilities and support staff, allows scientists to conduct long-term clinical studies of individual patients and large families that would be difficult, if not impossible, to do in the extramural community because of the lack of sufficient and long-term funding. It also provides an excellent setting for the training of clinical investigators.

The External Advisory Committee agrees with the need for renewal of the Clinical Center. The question is not whether it should be renewed but what is the most appropriate plan for renewal of the facilities that would meet the needs of the intramural research program and be as timely and affordable as possible.

Based on the findings described above, the Committee concluded that the plan for renewal of the Clinical Center hospital should be based on a target of 250 beds. There are several reasons for selecting this number of beds, not the least of which are the current relatively low occupancy rate of 58 percent and the number of very good to outstanding clinical protocols active at any one time. The accepted historical philosophy of rigidly dedicating a set number of beds for each institute is no longer acceptable, necessary, nor cost effective. There is both the potential and need for greater efficiency in use of the Clinical Center patient facilities through carefully developed procedures that minimize the need to assign specific beds to specific institutes without sacrificing the quality or implementation of clinical studies.

The Clinical Center staff already has developed thoughtful plans for creating a more flexible nursing/technical staff and a more centralized management system. In addition, current trends toward more outpatient care and less inpatient care will reduce the demand for beds. Finally, if the IRP moves toward reducing the number of clinical protocols ranked as "poor" or "obsolete" and rigorously employs the quality review processes recommended in other sections of this report, the demand for beds will decrease as downsizing occurs. Procedures to improve flexibility and quality will be required in response to the administrative mandate requiring reductions in staff. The External Advisory Committee is confident that Clinical Center staff are already moving in an efficient and well thought out direction toward downsizing.

With regard to the research laboratories in the Clinical Center, it is clear that many are overcrowded and in need of renovation. The Committee was concerned by the failure of NIH to maintain the physical plant of the Clinical Center. In part, this may reflect a lack of funds, but it also may reflect misplaced priorities or a lack of commitment to improving the physical infrastructure on the part of leadership. Institutes have varied considerably in the amount of funds expended for necessary maintenance and renovation.

In response to a Committee inquiry, several institutes indicated that the adjacency of beds and laboratories was of considerable value in facilitating translational clinical research because of enhanced interaction among basic and clinical scientists. In total, the ICDs estimated that approximately 49 percent of the laboratory facilities of the Clinical Center are placed on the same floor as the relevant clinical facilities. This provides for convenience, speed, and efficiency in pursuing research objectives. The ICDs further indicated that it would be desirable if an additional 38 percent of their clinical facilities and laboratories were in the same building but not necessarily on the same floor.

In the experience of members of the External Advisory Committee, this is an unusually high configuration of close proximity between laboratory space and inpatient nursing units. Based on experience in the extramural community and testimony of scientists who are or were located in Clinical Center laboratories, it is difficult to justify high levels of immediate adjacency compared to relative adjacency (e.g., within a 15 minute walk) if substantial incremental costs are required to achieve such immediate adjacency in the renewal of the Clinical Center research laboratories. It is likely that a rigorous analysis of the extent to which laboratory facilities must be immediately or closely proximal to clinical facilities would result in a proximal space requirement substantially less than the current Clinical Center configuration.

RECOMMENDATIONS

The External Advisory Committee recommends that additional options be developed for renewal of the Clinical Center taking into account the conclusions outlined above. A phased program of renewal of the Clinical Center should be developed consistent with the following specific parameters:

1. **An inpatient nursing facility of 250 beds as a new building physically proximate to the existing Clinical Center. The plans for and construction of this facility should proceed as promptly as possible.**

2. **The Deputy Director for Intramural Research should conduct a review to determine the portion of research laboratory facilities currently housed in the Clinical Center which require immediate adjacency to the inpatient nursing unit.**

TABLE 1:
SPACE DISTRIBUTION WITHIN THE
EXISTING CLINICAL CENTER COMPLEX[1]

Program	Net Square Feet[2]
HOSPITAL	
Inpatient Services	205,418
Outpatient Services	71,334
Diagnostic and Treatment	162,065
Support Services	107,633
Administrative Services	52,025
	598,475
RESEARCH	
Laboratory	413,609
Central Research Support	26,112
Vivarium	53,933
Administration - Institute Offices	54,328
	547,982
OTHER SERVICES	
Education Services	60,760
General Support Services	78,360
	139,120
PARKING	537,100

1 These data were developed by the Special Projects Branch of the Division of Engineering Services.

2 Net square feet is the useable floor space within the building. The net square footage is then multiplied by factors to equal the total existing building gross square footage of approximately 3 million square feet.

APPENDIX A:

LIST OF NIH INSTITUTES, CENTERS, AND DIVISIONS

Warren Grant Magnuson Clinical Center (CC)

National Cancer Institute (NCI)

National Institute for Nursing Research (NINR)

National Heart, Lung, and Blood Institute (NHLBI)

National Library of Medicine (NLM)

National Institute for Allergy and Infectious Diseases (NIAID)

National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK)

National Institute of Child Health and Human Development (NICHD)

National Institute on Aging (NIA)

National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS)

National Institute of Dental Research (NIDR)

National Institute of Environmental Health Sciences (NIEHS)

National Institute for General Medical Sciences (NIGMS)

National Institute of Neurological Disorders and Stroke (NINDS)

National Institute on Deafness and Other Communication Disorders (NIDCD)

National Eye Institute (NEI)

National Center for Human Genome Research (NCHGR)

Division of Computer Research and Technology (DCRT)

National Center for Research Resources (NCRR)
National Institute of Mental Health (NIMH)

National Institute on Drug Abuse (NIDA)

National Institute on Alcohol Abuse and Alcoholism (NIAAA)

APPENDIX B:

LIST OF ACRONYMS

AIDS -	acquired immunodeficiency syndrome
ADAMHA -	Alcohol, Drug Abuse, and Mental Health Administration
BSC -	Board of Scientific Counselors
CRADA -	Cooperative Research and Development Agreement
DDIR -	Deputy Director for Intramural Research
DHHS -	Department of Health and Human Services
ERP -	extramural research program
FY -	Fiscal Year
ICD(s) -	Institutes, Centers, and Divisions
IOM -	Institute of Medicine
IRP -	intramural research program
NIH -	National Institutes of Health
PHS -	Public Health Service
SBRS -	Senior Biomedical Research Service
SES -	Senior Executive Service
SSS -	Senior Scientific Service

APPENDIX C:

LIST OF DOCUMENTS REVIEWED BY THE EXTERNAL ADVISORY COMMITTEE

A. BACKGROUND, GENERAL BUDGET, AND POLICY INFORMATION

1. Cohen, J., "Is NIH's Crown Jewel Losing Luster?" *Science* 261, August 27, 1993.
2. DHHS/NIH 1994 Congressional Justification, Summary by Mechanism.
3. Draft Background Report on the NIH Intramural Research Program, prepared by the NIH Internal Fact-Finding Committee on the Intramural Research Program, October 7, 1993.
4. Draft ISI Proposal for Evaluation of NIH Research Using Publication and Citation Data.
5. Historical Overview—Evolution of the National Institutes of Health.
6. History of NIH Intramural Research by Major Category of Expense, October 7, 1993.
7. History of NIH Intramural Research, Major Category of Expense as Percent of Total, October 7, 1993.
8. House of Representatives, U.S. Congress, Departments of Labor, Health and Human Services and Education, and Related Agencies, Appropriations Bill, report language regarding review of the IRP, 1993, 1994.
9. Institute of Medicine, *Report of a Study, A Healthy NIH Intramural Program: Structural Change or Administrative Remedies?* (Washington, DC: National Academy Press, 1988).
10. Intramural Percent Total for Each ICD, October 7, 1993.
11. Intramural Research as Percent of ICD Total for Each ICD, October 15, 1993.
12. Intramural Research, Percent of NIH Total, October 7, 1993.
13. Intramural Research Program, by ICD and Year.
14. Intramural Research Program, Budget Process, October 15, 1993.
15. Intramural Research Program: ICD as Percent of Total NIH IRP, October 7, 1993.
16. Intramural Vs. Total Appropriations for Each ICD, Ranked by Intramural Share, FY 1992, October 7, 1993.
17. Memorandum for Heads of Departments and Agencies from President William J. Clinton, Subject: Streamlining the Bureaucracy, September 11, 1993.
18. National Support for Health R&D by Source, 1983-1993, October 7, 1993.
19. NIH Budget (FY 1992), Table A3, December 1993.
20. NIH Intramural and Total Budget, current dollars, October 7, 1993.
21. NIH Intramural and Total Budget, 1983 dollars, October 7, 1993.
22. NIH Intramural Vs. Total Appropriations, Fiscal Years 1983-1992, October 7, 1993.
23. NIH Response to Institute of Medicine Report, *Strengthening the Scientific Review Procedures of the NIH Intramural Research Program*, Report of a Consultant Panel to the Advisory Committee to the Director, NIH, December 1989.
24. Overview of NIH Budget Formulation Process, prepared by the Division of Financial Management.
25. Recent Changes in the NIH Intramural Research Program, briefing materials provided to the External Advisory Committee, December 1993.
26. Report of the Advisory Committee to the Director, NIH, January, 1990 on *Strengthening the Scientific Review Procedures of the NIH Intramural Research Program.*
27. *Report of the President's Biomedical Research Panel*, submitted to the President and the Congress of the United States (U.S. Department of Health, Education, and Welfare, Public Health Service, DHEW Publication No. (OS) 76-500), April 30, 1976.

28. Report of the Task Force on the Intramural Research Program of the National Institutes of Health (a.k.a. the "Klausner Report"), delivered to Dr. Bernadine Healy, Director, NIH, April 13, 1992.

29. Summary Tables for NIH Zipcode Project, August 18, 1993, Institute for Scientific Information, Philadelphia, Pennsylvania.

B. REVIEW PROCESS FOR TENURED SCIENTISTS AND SCIENTIFIC DIRECTORS

30. BSC Reviews in the Time Period October 1, 1991 to September 30, 1992, Table 1C, November 1993.

31. FY 92 Review of NIH Federal Advisory Committees, revised May 7, 1993.

32. Demographics of Intramural Tenured Investigators, briefing materials, December 1993.

33. Distribution of IRP Personnel by Category, FY 1993, Tables 6 and A6, December 1993.

34. ICD Personnel Data: Fiscal Year 1993, Table 9A, December 1993.

35. Levels of Support for Independent Investigators Who Have Received Negative Reviews, Table 1D, November 1993.

36. NIH response to External Advisory Committee query, "Describe the process or processes currently employed to review the quality of your intramural programs at all levels, from trainees to Scientific Directors, November 1993.

37. Number of Scientific Personnel in Intramural Laboratories, Table 5A, November 1993.

38. Personnel Classification (FY 1992): with FY 1993 Supplement, Table A5, December 1993.

39. Possible Options for Consideration in Reducing NIH Staff, NIH response to External Advisory Committee request for information, February 17, 1994.

40. Report of Board of Scientific Counselors Review, tables listing 1991, 1992, and 1993 meetings of Boards, provided to the External Advisory Committee October 1993.

41. The Intramural Scientific Review Process, position paper submitted by the NIH Internal Fact-Finding Committee on the Intramural Research Program at the request of the External Advisors, December 1993.

C. THE REVIEW PROCESS FOR TENURE

42. Liotta, L.A., *Tenure Track Program of the National Institutes of Health*, National Institutes of Health, 1993.

43. NIH Intramural Research Program Tenure-Track Procedures, Draft, August 9, 1993.

44. NIH Intramural Tenure-Track Policy, Draft, February 19, 1993.

45. Non-Tenure Track Scientists: By Mechanism—FY 1993, Table 9B, ICD Responses, December 15, 1993.

46. Predoctoral and Postdoctoral Fellows and Tenure-Track Scientists (FY 1993), ICD Responses, December 1993.

47. Recruitment for Tenure (Independent Research Investigators), Table 1A, November 1993.

48. Sample NIH Tenure Track Agreement, Draft, 1993.

49. Tenured and Tenure Track Scientists, Table 1B, November 1993.

50. "The Review Process for Tenure," position paper submitted by the NIH Internal Fact-Finding Committee on the Intramural Research Program at the request of the External Advisors, December 1993.

D. TRAINING

51. "Graduate Student Programs," position paper submitted by the NIH Internal Fact-Finding Committee on the Intramural Research Program at the request of the External Advisors, December 1993.

52. Intramural Postdoctoral Training Programs, December 1993.

53. Pharmacology Research Associate Program, December 1993.

54. Post-Docs: 1988 and 1992 (from Table 1B: November 10, 1993) revised and distributed February 25, 1994.

55. Predoctoral and Postdoctoral Fellows and Tenure-Track Scientists (FY 1993), Table 8, December 1993.

56. "Role of Postdoctoral Fellows in the Intramural Program", position paper submitted by the NIH Internal Fact-Finding Committee on the Intramural Research Program at the request of the External Advisors, December 1993.

57. Trainees: By Mechanism, FY 1993, Table 9C, December 15, 1993.

E. ORGANIZATIONAL ISSUES AFFECTING RECRUITMENT AND RETENTION

58. "Mechanisms for Enhancing the Attractiveness of the NIH Intramural Research Program for Senior Scientists," position paper submitted by the NIH Internal Fact-Finding Committee on the Intramural Research Program at the request of the External Advisors, December 1993.

59. NIH Response to External Advisory Committee query, "Describe briefly, from your ICDs' perspective, the organizational issues that are disincentives to the support of the highest-quality research and training in the intramural programs," November 1993.

60. "Organizational Issues Which Are Disincentives to the Support of the Highest Quality Research and Training in the Intramural Program," position paper submitted by the NIH Internal Fact-Finding Committee on the Intramural Research Program at the request of the External Advisors, December 1993.

F. NIH-PRIVATE SECTOR COLLABORATIONS

61. Assistant Secretary for Health Memorandum to Acting Inspector General, OS, Subject: Office of Inspector General Draft Report "Technology Transfer and the Public Interest: Cooperative Research and Development Agreements at the National Institutes of Health," OEI-01-92-01100, October 8, 1993.

62. Clinical Center Protocols Turned Over to the Private Sector for Development and Evaluation, Table 3C, December 1993.

63. CRADA Activity—All ICDs Combined, Table 7, December 15, 1993.

64. CRADA Activity, by ICD, Table 7, December 1993.

65. Department of Health and Human Services, Office of Inspector General, Technology Transfer and the Public Interest: Cooperative Research and Development Agreements at NIH, November 1993.

66. History of CRADA and Conditional Gift Funds: NonFederal Support, Bar Graph 7, November 1993.

67. NIH Actions in Response to the Report on PHS CRADAs, December 15, 1993.

68. NIH CRADA Guidelines, draft, November 9, 1993.

69. "NIH-Private Sector Collaborations," position paper submitted by the NIH Internal Fact-Finding Committee on the Intramural Research Program at the request of the External Advisors, December 1993.

70. Outside Activities of IRP Scientists, 1993, Table 2, ICD Responses, December 1993.

71. Phase III and Phase IV Clinical Trials, Table 4, December 1993.

G. PROCESS FOR ALLOCATING FUNDS BETWEEN THE EXTRAMURAL AND INTRAMURAL PROGRAMS

72. Balance Between IRP/ERP, Tables 2A-2D, November 1993.

73. NIH Response to External Advisory Committee query, "Describe the process by which the size of the (1) scientific, (2) administrative, and (3) training components of your intramural programs are determined. (How are decisions made regarding allocation of resources and the balance between IRP and ERP)," November 1993.

74. "Process for Allocating Funds Between the Extramural and Intramural Programs," position paper submitted by the NIH Internal Fact-Finding Committee on the Intramural Research Program at the request of the External Advisors, December 1993.

H. RENEWAL OF THE CLINICAL CENTER

75. Amount of Space Allocated to Intramural Laboratories (FY 1993), Table 5C, November 10, 19993.

76. Annual Inpatient Admissions, NIH Clinical Center, October 7, 1993.

77. Average Cost for Intramural Scientists (FY 1992), Table A1, December 1993.

78. Average Inpatient Occupancy by Institute and Day-Of-Week, Fiscal Year 1993, December 1993.

79. Average Length of Stay, NIH Clinical Center, Total Admissions, Less NIMH, NIAA, October 7, 1993.

80. Average Length of Stay, NIH Clinical Center, NIMH, NIAA, and All Other, October 7, 1993.

81. Buildings and Facilities, Appropriation History (Dollars in Thousands) 1975 to 1984, and 1985 to 1994, April 7, 1993.

82. Clinical Center Bed Occupancy: February 16, June 15, October 29, 1994, Table 5, December 1993

83. Clinical Center Complex, Clinical Research Program Handouts, Renewal Options, Project Briefing, December 10, 1993.

84. Clinical Center Renovation/Construction Options, NIH response to External Advisory Committee request for information, January 11, 1994.

85. Clinical Center Summary Data, October 7, 1993.

86. Clinical Research Costs (Dollars in thousands), Table 3C, November 1993.

87. Clinical Research Program, briefing materials presented to the External Advisory Committee, December 1993.

88. Clinical Protocol Rankings, December 1993.

89. Clinical Trials (dollars in thousands), DHHS/NIH, April 20, 1993.

90. Clinical Trials, Narrative Examples, November 10, 1993.

91. Costs for Developed Options I, II, and III, January 1994.

92. Current beds/staffing at the Clinical Center, NIH response to External Advisory Committee request for information, January 14, 1994.

93. Data on National Hospital Construction Projects, collected by NIH Special Projects Branch, February 17, 1994.

94. Drug Discovery and Transfer, 1988-1993, Table 1, December 1993.

95. FY 1994 Unit Costs for Hospitals and Laboratories adjusted to the Washington D.C. area, January 1994.

96. FY 1993 Contracts in Support of Clinical and Laboratory Research, NIH response to External Advisory Committee request for information, January 14, 1994.

97. Graphs of Clinical Center Inpatient Activity, memorandum from Management Analyst, EO, CC, to Edward J. Lynch, OSPL-OD, December 22, 1993, includes "NIH Clinical Center Average Occupancy by Institute FY 1993," and "NIH Clinical Center Inpatient Beds Occupancy FY 1993."

98. Hospital Statistics—1989 Data, October 7, 1993.

99. ICD Response to External Advisory Committee query "Provide the rationale for having your patient-oriented clinical research protocols in the intramural programs instead of the extramural," November 1993.

100. Innovative Projects Without Guarantee of Success, NIH response to External Advisory Committee request for information, December 1993.

101. Inpatient Bed Occupancy by Day-of-Week, December 1993.

102. Intramural Clinical Trials, Table 3A, November 10, 1993.

103. Institute responses related to the justification for the use of the Clinical Center, January 11, 1994.

104. IRP Net Usable Space: Total and Per Person (FY 1992), Table A2, December 1993.

105. Memorandum dated October 18, 1993, from Acting Director, Clinical Center to Scientific Directors of ICDs with Intramural Clinical Programs, regarding Response to FTE Cuts in CC FY 1994 Budget: Proposals for Consolidating Patient Care Units.

106. National Institutes of Health, Clinical Center Complex, Bethesda, Maryland, Program Justification Document, Office of Research Services, Division of Engineering Services, February 1993.

107. NIH Clinical Center Institutes Assessments, 1982-1992, Current Dollars, October 14, 1993.

108. NIH Expenditures for Renovation, Construction and Maintenance, February 22, 1994.

109. NIH Intramural Contracts FY 1993: Support for Clinical and Laboratory Research, December 1993.

110. NIH Intramural Contracts FY 1993: Operational Support for Off-Campus Clinical and Laboratory Research, December 1993.

111. NIH Intramural Research Costs Vs. Clinical Center Assessments, October 7, 1993.

112. Net Usable Space, (net square feet) Total of On- and Off-Campus, Table 2B, December 1993.

113. Need for Proximity Between Laboratories and Clinical Facilities, Table 6, December 1993.

114. Outpatient Clinic Visits, NIH Clinical Center, October 7, 1993.

115. Presentation to External Advisors NIH Intramural Research Program Review, October 15, 1993, by the Office of Research Services, Division of Engineering Services.

116. Professional Planning Guidelines for a Proposed 300 Bed Hospital, NIH response to External Advisory Committee request for information, February 17, 1994.

117. Proposed Patient Care Unit Consolidations, Attachment 1, Revised 10/18/93.

118. Ranking of Clinical Center Research Protocols for 1993, ICD Responses - December 1993.

119. "Renewal of the Clinical Center (options)," position paper submitted by the NIH Internal Fact-Finding Committee on the Intramural Research Program at the request of the External Advisors, December 1993.

120. Research Beds Off NIH Campus, December 1993.

121. Selected Clinical Center Inpatient Data, October 7, 1993.

122. Services and Supply Budgets of Intramural Laboratories (FY 1993), Table 5B, November 1993.

123. Status of Clinical Center Protocols: 1988-1993, Table 3B, December 1993.

124. Total Budgets for Laboratories or Branches (FY88-FY92), Table 8, November 1993.

APPENDIX D:

MEETING DATES OF THE EXTERNAL ADVISORY COMMITTEE

October 15, 1993

November 12 and 13, 1993

December 10, 1993

January 27 and 28, 1994

February 25, 1994

Implementation Plan and Progress Report External Advisors' Report on the NIH Intramural Programs

November 17, 1994

IMPLEMENTATION PLAN AND PROGRESS REPORT EXTERNAL ADVISORS' REPORT ON THE NIH INTRAMURAL PROGRAMS

Introduction

In response to a Congressional request to review the "role, size, and cost" of the NIH Intramural Research Programs, an External Advisory Committee (EAC) was constituted as a subcommittee to the Advisory Committee to the Director, NIH. Chaired by Dr. Paul Marks, (Memorial Sloan-Kettering Research Foundation) and Dr. Gail Cassell (University of Alabama School of Medicine), the EAC submitted a report to the NIH Director on April 11, 1994. This report included recommendations concerning seven different aspects of scientific research at the NIH: (1) the review process for tenured scientists and Scientific Directors; (2) the review process for tenure; (3) postdoctoral training; (4) organizational issues affecting recruitment and retention; (5) NIH-private sector collaborations; (6) the process for allocating funds between extramural and intramural programs; and (7) the renewal of the Clinical Center. There are eleven major recommendations stated in the Executive Summary of this report, and the individual subsections enumerate a total of 42 specific recommendations, many of which provide a detailed prescription for altering or strengthening the process by which intramural research is currently conducted.

The goal of the report of the EAC is to re-invigorate a distinguished scientific institution by improving the uniformity and rigor of its scientific review and recruitment processes, reducing administrative impediments to research so as to aid in recruitment and retention of the most capable and diverse scientific staff, and revitalizing the Clinical Center, which is a unique feature of the Intramural Research Programs through which basic science is translated into new and improved diagnosis, treatment and prevention of disease as well as improved patient care.

Eight months after the submission of this external review, we are pleased to provide a detailed accounting of the changes in the Intramural Program that have occurred, and to offer a synopsis of progress in those areas in which changes are anticipated, but have not yet been accomplished. All of the 42 recommendations made in the report have been discussed by the NIH Director and the Deputy Director for Intramural Research (DDIR) with the Scientific Directors and the Internal Working Group on the Intramural Program. Comments from the NIH scientific staff have been viewed, and several of the proposed changes have been acted on by the Directors of Institutes, Centers and Divisions (ICDs) at the NIH. The process of revitalization of the Intramural Programs envisioned by the External Advisors' Report has begun in this collegial spirit, and we believe the result, as detailed in this implementation plan, is a thoughtful re-evaluation and substantial re-working of many of the processes by which science is reviewed and administered in the intramural programs.

The format of this "Implementation Plan and Progress Report" is modeled after that of the EAC Report. An introduction to each section that summarizes the major changes that have occurred in response to the EAC Report is included, followed by a point-by-point discussion of the individual recommendations within each section keyed to the recommendation numbers in the original EAC Report.

(1) Review Process for Tenured Scientists and Scientific Directors

The review process by which intramural science is reviewed has been altered to respond to concerns expressed in the EAC report. A Manual Chapter on "Review and Evaluation of Intramural Programs" has been revised significantly following a series of meetings by the Deputy Director for Intramural Research with chairs of the Boards of Scientific Counsellors (BSCs), and the Scientific Directors. The DDIR has met with most of the chairs of the BSCs to emphasize the importance of independent, rigorous, and explicit reviews to aid the Scientific Directors in distributing resources within each intramural program.

Recommendation #1 (Meeting of BSC Chairs): The then Acting DDIR met with the chairs or their representatives of all of the Boards of Scientific Counsellors (BSCs) on August 1, 1994. A list of the attendees at this meeting is included in Appendix I. The current Federal Government requirement that standing advisory committees be reduced constrains the establishment of a standing "External Advisory Committee to the Intramural Research Program," as suggested by the External Advisors. However, the BSC chairs will meet annually as informal consultants to the DDIR as proposed in the EAC

Report, to describe the state of each intramural program, and to discuss strengths and weaknesses in each review process. The next meeting of the BSC chairs is scheduled for January 19, 1995.

Recommendations #2 and #3 (BSC membership and review process): The first meeting with BSC chairs resulted in a detailed list of proposed changes in the review process used by the BSCs, the intent of which was to make more rigorous and uniform the intramural review process. These recommendations have been discussed with the NIH Director, the Scientific Directors, and the ICD Directors, and reformulated as a revised "Manual Chapter." This Chapter spells out specific guidelines for the selection of BSC members, selection of BSC chairs, the nature of the review process to be used by BSCs, and the review of the Scientific Director. This Manual Chapter, included as Appendix II, will be provided to every incoming BSC member, and will be summarized in revised Orientation Guidelines to be provided to each BSC member and to ad hoc members of site visit teams that review intramural programs.

The new Manual Chapter strongly enforces the major goals of the recommendations made in the EAC Report to increase the independence, rigor, and uniformity of the review process, and to emphasize the primarily retrospective nature of the review of intramural research and its critically important advisory function to the Scientific Directors. This has been done by: (1) specifying that new BSC members and chairs are recommended by the ICD Directors with the approval of the NIH Director and the DDIR; (2) requiring that all written reviews of the BSCs include explicit recommendations for resource allocation; (3) establishing a new proceedure for periodic review of Scientific Directors consisting of an *ad hoc* external committee chosen by the ICD Director in consultation with the NIH Director and the DDIR; and (4) emphasizing that the process by which intramural research is reviewed is different from the process used extramurally in that it is primarily (albeit not exclusively) retrospective.

The detailed recommendations made in the EAC Report about how to achieve the goals outlined above differ somewhat from the final recommendations made in the Manual Chapter. In some cases these differences represent limitations inherent in the way the Federal Government conducts its affairs; in others they represent legitimate differences of opinion about how best to achieve the goals of the EAC Report. Specific differences between the requirements of the revised Manual Chapter and the EAC Report are as follows: (1) BSC members and chairs are not to be chosen by a vote of the current BSC, since government policy on standing committees requires that a government official appoint advisory committee members, and there was concern that allowing the current BSCs to choose their own membership might delay implementation of changes in the review process ; (2) The review of the Scientific Director will be by an independent ad hoc committee, established by the ICD Director, rather than by the BSC itself. Since the BSC is advisory to the Scientific Director on matters of science, it is not an appropriate body to review the administrative prowess or leadership capability of the Scientific Director, which is best done by an independent committee constituted for this purpose. Furthermore, the relationship of the BSC and the Scientific Director changes substantially if the committee which is giving advice can influence the Scientific Director in any way to respond to that advice, making the BSC the de facto director of intramural research; (3) Tenure-track scientists will be reviewed as close as possible to the middle of their 6-year tenure track period on the same cycle as their laboratory (reviewed every 4 years); (4) Terms of BSC membership will remain at 5 years, since this allows at least some BSC members to see each laboratory twice in the 4-year review cycle. (The BSC chairs were adamant that they should not be subject to "double jeopardy" regarding service on other NIH panels and advisory committees. Although not explicitly stated in the Manual Chapter, a two-term limitation would be generally enforced by the ICD Directors, the DDIR, and the NIH Director); and (5) The possible limitation of the length of background material and the retrospective vs. prospective balance of the scientific presentations has been a subject of considerable debate. The revised Manual Chapter *suggests* limits on the length of the report (3-5 pages), and emphasizes the retrospective nature of the review, but indicates that some part of the presentation should deal with future plans (1-2 pages). This represents a compromise reflecting the diverse opinions expressed by the BSC chairs, the Scientific Directors, the EAC Report, and the DDIR, and, it is believed that it should not have negative impact on the rigor of the review process.

(2) Review Process for Tenure

In keeping with evolutionary changes which have been occurring in the Intramural Research Program over the past several years, and incorporating suggestions from the EAC Report, a completely new Tenure Program has been developed at the NIH. A description is presented in Appendix III. Highlights of the program include a requirement for national searches for all tenure-track positions, formal agreements by ICDs with all tenure-track scientists which spell out independent resources for personnel, budget and space, a 6 year tenure-track with mid-period review which includes stop-the-clock provisions for any scientist who wishes to take time off for personal reasons, and a new NIH Central Tenure Committee consisting of 15 senior NIH scientists, advisory to the

DDIR, which replaces the Board of Scientific Directors in making final recommendations on all tenure decisions (Appendix IV).

This new Tenure Program has been approved by the Board of Scientific Directors, the ICD Directors, and the Director, NIH. Final approval by the Public Health Service is needed to allow for the extension of the appointments of some staff so that they can be enrolled or continued in the tenure-track.

Recommendations #1- #4 (Establishment of a new Tenure Program): The Tenure Program that has been established is identical in virtually all respects to the program recommended by the External Advisors, except that the Central Tenure Committee will not be responsible for approval of tenure-track candidates. These decisions will be made by the Scientific Director and ICD Director, with concurrence of the DDIR. However, to assure that the process by which searches are conducted to identify the best possible candidates for tenure-track positions is fair and rigorous, the search committee must have a chair who is an expert in the scientific area but is not the Laboratory or Branch Chief in the Laboratory or Branch in which the position has been created, representation by women and minority scientists, an ex officio member from the ICD's EEO office, and a representative chosen by the DDIR from recommendations made by the major scientific special interest groups. The final composition of this committee, and the candidate chosen by the ICD must be approved by the DDIR. As needed, the DDIR will seek the advice of representatives of the NIH Central Tenure Committee, or other expert advisors.

(3) Postdoctoral Training

The EAC Report points out that the NIH IRP is the single largest postdoctoral biomedical training institution in the U.S., but few resources have been committed to develop a coordinated program to recruit, mentor, and track NIH post-doctoral fellows for quality and diversity. While an Office of Education has been in existence within the Intramural Program, such training programs will be enhanced by the formation of a new Office of Science Education which will utilize existing resources more efficiently to oversee all intramural and extramural educational activities, and will aid in the coordination of these activities. This new office will be in the immediate Office of the NIH Director and will consist of three major activities: (1) Extramural and outreach; (2) Intramural training ; and (3) Loan repayment and scholarship. The activities related to Intramural Training and Loan Repayment and Scholarship are described below. An Advisory Committee, chaired by the DDIR, will oversee educational projects in the new Office of Science Education.

In addition to the establishment of the Office of Science Education, a new focus will be created in the Intramural Program for training and mentoring of postdoctoral fellows. Thus, education of postdoctoral fellows will take its place beside biomedical research activities as a major goal of the intramural program. The implementation of this new post-doctoral training program, facilitated by the suggestions contained within the EAC Report, will have many components which are outlined below:

Recommendation #1 (Training Faculty): Efforts described elsewhere in this document detail the initiatives designed to revitalize and maintain the quality of the intramural program.

Recommendation #2 (Recruitment): Because the intramural program trains nearly 15% of the nation's postdoctoral fellows in the biomedical sciences, it bears a special responsibility to ensure that it recruits from a diverse, well-qualified applicant pool and identifies the most outstanding postdoctoral candidates. Initiatives to do this are summarized below and include a broad-based advertising effort, targeted recruitment to ensure that the appropriate candidates are reached, and a program of incentives for potential trainees.

(1) *Implementation of a broad-based advertising campaign.* As part of a recent effort, advertising for clinical and postdoctoral positions has been centralized in the Office of Science Education. Potential candidates are now informed of positions across all of the institutes in the intramural program through full page advertisements in *Science, Cell,* the *New England Journal of Medicine* and other appropriate journals. To further facilitate a prospective trainee's exploration of intramural opportunities, a catalog summarizing NIH intramural training opportunities has been made available over the Internet. Instructions for accessing these additional resources are carried in each advertisement. Initiatives for direct mailings and for exhibits at scientific meetings round out the advertising campaign. Direct mail is used to reach all potential clinical trainees in the nation, who, by nature of their training, may be candidates for NIH subspecialty and research training programs. The lack of similar databases for graduate students and postdoctoral fellows limits the efficacy of this technique for reaching prospective postdoctoral Ph.D. fellows. However, direct mailing is now being used for targeted recruitment as described below. In addition, recent efforts to exhibit intramural opportunities at scientific meetings is proving to be a useful way to contact graduate students and postdoctoral fellows who may wish to consider intramural training opportunities.

(2) *Targeted recruitment.* Targeted recruitment efforts have been implemented to ensure that the applicant pool is diverse and well-qualified. This has involved two

separate initiatives that overlap in the populations they reach. One initiative targets populations who have been traditionally underrepresented in the sciences. A second targets prospective candidates who, by the nature of their previous research experience or training, are considered to be highly competitive candidates for intramural training. Since the initiatives are quite similar in the methods employed, they will be discussed together here. Direct mailing is a major component of targeted recruitment. Descriptions of NIH intramural training opportunities have been mailed to MD/PhD students, former Howard Hughes Medical Institute Research Scholars, MARC scholars and predoctoral students and minority students supported on NIH research grant supplements and on National Research Service Award (NRSA) predoctoral training grants. Plans are being developed to expand, as much as possible, the direct mailing effort to include the extramural population of students supported by the NRSA program, by National Science Foundation predoctoral fellowships, and fellowships from the Howard Hughes Medical Institute. The direct mailing program is supplemented by advertising in the special sections in *Science* devoted to minority scientists and to women scientists as well as in journals targeting minority scientists and physicians. In addition, exhibits on intramural opportunities are now shown at meetings targeting minority scientists, e.g., the National Institute of General Medical Sciences Minority Programs Symposium, the Research Centers in Minority Institutions International AIDS Symposium, and the National Science Foundation Diversity Conference.

(3) *Incentives for Trainees.* The intramural program strongly agrees that incentives are needed to attract talented individuals into biomedical research training programs. In its recommendations the Committee suggested that two programs be established—(a) a program for repayment of educational loans analogous to that offered by the National Health Service Corps and (b) a Distinguished Scholars Program.

(a) Loan Repayment. Such efforts have been vigorously pursued by the NIH for a number of years. Since 1989 the NIH has had a program providing repayment of educational debt for individuals entering the intramural program to engage in AIDS-related research. This authority was extended in The National Institutes of Health Revitalization Act of 1993, Public Law 103-43, and provides authorization for two additional loan repayment programs and a scholarship program specifically relevant to the intramural program. The Director of NIH has recently implemented one of the loan repayment programs to provide repayment of educational debt for clinicians from disadvantaged backgrounds, including minorities, who are entering clinical research training or performing clinical research within the intramural program. In a second program slated for implementation within the next two years, the repayment of educational debt would be extended to cover biomedical research generally. In addition, the NIH has received authorization for an undergraduate scholarship program for persons from disadvantaged backgrounds—an effort that is expected to encourage minorities and others to pursue intramural training and careers in the biomedical sciences.

(b) Distinguished Scholars Program. There is great interest in establishing a program to recruit the highest quality scientific personnel. There are two possible approaches to this goal, both of which are being pursued. In the first,under contract, the National Research Council of the National Academy of Sciences will do outside review of applicants for a senior post-doctoral training program. This program has been in existence at the NIH for several years, but it has now been expanded and more clearly defined as highly selective. The second approach involves extension of NIH training authority to the Office of the Director and has been requested from Congress.

Recommendation #3 (Selection of postdoctoral fellows): As detailed in the response to Recommendation #2, a broad-based advertising and direct mailing campaign is underway. At present the applications for a postdoctoral position, specifically the Intramural Research Training Award, which require inclusion of history of educational experience, publications, research presentations, etc. are used by intramural faculty to identify and ultimately select the highest quality candidates available.

Recommendation #4 (Independence and career development of fellows): The EAC has rightly emphasized the importance of career development and independence for trainees. The intramural program is currently developing an overall approach to mentorship and career development for its trainees. Although the plan is under development, it will likely include the following features, portions of which are in the process of implementation.

(1) *Graduated independence.* The commitment to providing graduated increases in responsibility and independence is a critical element in the revitalization of intramural training. In keeping with that commitment, postdoctoral fellows now entering intramural training will be expected, in general, to remain for only 2 to 4 years, but not to exceed 5 years, and then seek other positions offering increased independence.

(2) *Centralization of training information on all intramural fellows.* A centralized database will be designed to provide the intramural program with the capability of monitoring the quality of incoming trainees, monitoring the

quality of the intramural experience, contacting trainees directly about training issues, and initiating the process of tracking the careers of fellows who have completed intramural training.

(3) *Guidelines for one-on-one mentorship.* Incoming postdoctoral fellows in each of the ICDs receive training in issues related to the conduct of science and a copy of NIH "Guidelines on the Conduct of Science". Additional guidelines on the roles and responsibilities of fellow and mentor will be developed as part of an expanded discussion among the faculty, fellows, and administration about intramural training. The consensus document will be circulated to current and incoming fellows and all tenured intramural faculty to bring clarity and uniformity to expectations and responsibilities for participants in the training process. It is anticipated that the document will continue to evolve just as the training relationship will. The Women Scientist Advisors and the Working Group on Under-represented Minority Scientists have also begun to develop mentorship programs.

(4) *Opportunities for institutional mentorship.* Institutional mentorship subsumes those efforts and programs that can be provided to facilitate the fellows' transition into postdoctoral training, optimizes their training experience, and facilitates the successful transition to an independent career.

(a) Facilitating the transition into postdoctoral training. An NIH Postdoctoral Fellows Handbook is being developed to provide every incoming fellow with basic information about the training experience, the institution, and quality of life issues. The handbook, developed in consultation with the NIH Fellows Committee, will cover over 70 topics including such items as educational opportunities on the intramural campus, expectations for postdoctoral training, commonly asked questions about benefits and insurance and day care information.

(b) Optimizing the Training Experience. To optimize the training experience, new programs have recently been offered to meet needs identified by fellows. Two examples include an Introduction to Molecular Biology for Postdoctoral Fellows and A Short Course and an Introduction to the Computer Resources on the NIH Campus. Under development by the Clinical Center is an introductory course in clinical research. This course, designed to prepare fellows for careers in clinical research, will provide instruction in such topics as experimental design, biostatistics, grants, ethics and human subject research considerations, the infrastructure required for clinical research, clinical studies and regulatory agencies including the FDA, quality assurance in large scale trials, gender and racial diversity in study populations, legal issues, and technology transfer considerations.

(c) Facilitating the transition to an independent career. Programs addressing the transition to an independent career have been offered recently and include: *Funding and Collaborative Research Opportunities in the Private Sector, a Workshop; Pursuing a Career in Academia*—a Workshop; *Postdoctoral Fellows Forums on Tenure Issues;* and *Biomedical Science as Viewed by the American Public through the Eyes of the Media.* Future programs are expected to include such topics as managing personnel, resources, and science in a research laboratory; the role of the scientist in making science policy; the role of scientific societies in the research enterprise; and the need for broader training of fellows in preparation for careers outside of academia.

(5) *Opportunities for networking, visibility, and exposure.* As part of the process of revitalizing the intramural campus and providing new opportunities for fellows, special interest groups of scientists in a wide variety of biomedical disciplines have been organized on campus. These organizations offer opportunities for fellows to interact with scientists across the intramural program. Additionally, nearly every week throughout the academic year, the special interest groups will host internationally recognized scientists from outside the NIH who will deliver a seminar and be available for meeting with interested scientists and fellows. Poster sessions are also planned following the seminars which will offer fellows an opportunity to present their work. The NIH Fellows Committee have chosen and are hosting three of this year's speakers. In addition, the Scientific Directors have agreed to support an annual symposium organized by the Fellows Committee.

(6) *Opportunities for recognition.* Recognition by one's scientific peers has value in advancing the careers of students and fellows and in providing encouragement to achieve excellence in research. The Scientific Directors, through their intramural travel funds, have agreed to support an award program based on abstracts submitted. Under consideration is the creation of a database of awards, fellowships, and other sources of recognition for which fellows could apply.

(7) *Expansion of opportunities for input from fellows.* The NIH Fellows Committee, recently established, has afforded the community of fellows an avenue to work with the NIH administration on issues of training, education, and the quality of life for fellows within the intramural program. An electronic bulletin board has been developed to foster discussions among fellows, faculty, and the administration. This complements the invitations from the NIH leadership to fellows welcoming suggestions by e-mail or fax.

(8) *Opportunities for employment.* In its infancy is a new database developed by the Office of Education for fellows completing intramural training. The database lists employment opportunities in academia and the private sector. It also provides pointers to other extant databases listing academic positions. The service is provided free to all advertisers. As another service to fellows, the NIH will participate in an electronic system that transmits the resumes of fellows seeking employment to interested parties in the private sector and academia.

(9) *Under-represented Groups.* Women, minorities, and disabled scientists in training in the intramural program have articulated needs critical to the development of a diverse scientific workforce. Recommendations from women scientists and fellows have led to the establishment of Women Scientist Advisors who report to the Scientific Director in each ICD. One of the first achievements of this group has been the development of evidence related to pay discrepancies between men and women scientists in many of the intramural programs. The advisors also provide information, guidance, and a source of contacts for fellows who are women. How to address the differing needs of minority fellows is currently under exploration by a Working Group of Under-represented Minority Scientists impaneled by the DDIR. One of the recommendations is to provide a special programs officer within the Office of Science Education to act as a focal point for issues affecting the recruitment, training, and advancement of all fellows with particular emphasis on those underrepresented in the sciences. As part of this process, a network of advisors and mentors may be established for fellows who need career guidance in addition to that offered by their scientific preceptors.

(10) *Evaluation.* Evaluation of program quality is an essential part of any mentorship and career development program. Development of an assessment program for the intramural program is in the planning stages and is described in more detail in the response to Recommendation #6 (see below).

Recommendation #5 (Diversity): A series of initiatives has been implemented to increase racial and ethnic diversity among trainees.

(1) *Closer coordination between the intramural program and NIH programs supporting minority students is underway.* As part of that effort the intramural program is contacting students in the MARC program (undergraduates and predoctoral students), NRSA predoctoral minority fellows, and students supported by minority supplements to NIH grants to inform them about the NIH intramural training opportunities. In addition, internship positions are being used across the intramural campus to bring MARC scholars to the intramural program during the summer so that they may better understand the opportunities for intramural training in the future and receive encouragement to continue their pursuits of research careers.

(2) *The Intramural Training Awards Program* has been expanded recently to offer research training positions for medical students and recent recipients of the baccalaureate degree. This program is seen as a new tool that can be used to target underrepresented minorities and provide them with an experience that may encourage them to consider intramural training and ultimately careers in research. The research positions extend for 1-2 years prior to graduate or medical school. In addition, a stay-in-school IRTA program has been established for full-time students in high school and college who are economically disadvantaged . This program provides stipends for students to work as laboratory trainees half-time throughout the school year and full-time during the summer months.

(3) *The Loan Repayment Program for Clinical Researchers from Disadvantaged Backgrounds* and the soon to be implemented scholarship program for undergraduates from disadvantaged backgrounds are seen as attractive incentives to provide ethnic diversity within the intramural training program. These programs are described in the response to Recommendation #2.

Recommendation #6 (Assessment): The intramural program is in agreement with the need to assess the quality of the training it provides. Currently in the planning stage is an evaluation that will have the following components:

(1) *Assessment of the quality of incoming intramural trainees.* A centralized database of all intramural trainees will be established, including degrees, educational institutions attended, grades, prior research experience, site and type of prior clinical training, publications, awards, etc. This information will be used to monitor the quality of incoming clinical and postdoctoral trainees.

(2) *Assessment of the quality of the intramural training experience.* Plans are being developed to evaluate the intramural experience using indicators that will be collected during the period of training as well as regularly after the completion of training.

(a) Evaluation during the period of intramural training. Under consideration is an evaluation program that would be modeled after the evaluation efforts established for clinical trainees in accredited residency and subspecialty programs. Such analysis would include evaluation of the training program by both the trainees and the preceptors, evaluation of the trainee by preceptor

and of the preceptor by the trainee. Additional measures of performance may include publications, abstracts, scientific presentations, awards, meetings attended, courses taken, etc. An exit questionnaire, to be completed anonymously and a separate form inquiring about any position accepted after training, as well as information providing forwarding address(es) to be used for tracking purposes would be given to each fellow approaching the completion of training. Completion of these forms would be encouraged as part of the separation process. A questionnaire has been designed for this purpose and is being tested at present.

(b) Evaluation following intramural training. Planning is underway to establish a tracking system to follow the progression of the careers of intramural trainees with the aim of using these data to improve the efficacy of intramural training. Several options are under consideration: (1) A system similar to that required for trainees supported on NIH NRSA training grants is under consideration; however, the means to follow such trainees is limited to those who may also appear in other databases including the Contracts & Grants Award File at NIH, the AAMC Faculty Roster System, the Doctorate Recipients File, and the Survey of Doctorate Recipients. Alternatively, under consideration is a more detailed tracking system that would follow trainees for a decade upon completion of training. Former trainees would be contacted, perhaps on a biennial basis, to provide an update on the status of their careers. The initial follow-up at two years may well include an evaluation of the value of their training experience given the perspective of the first two years of employment. Since such a tracking program may prove to be a model for other institutions, the planning may also include input from the NRC, the AAMC, academia, extramural and intramural NIH, NSF and others.

(4) Organizational Issues Affecting Recruitment and Retention

The need to "reinvent government" to make it more attractive to outstanding junior and senior scientists is felt keenly by the current NIH leadership. The intramural program has initiated a major effort to identify those aspects of the operation of the NIH which would benefit from streamlining and re-engineering. A working group on "intramural re-invention", chaired by the Deputy Director for Intramural Research and the Executive Officer of NHLBI, has made a large number of recommendations for changes which can be implemented either at the NIH, at the level of the Department of Health and Human Services, or as a result of legislative change. The major principles underlying these recommendations are: (1) authority should be delegated down to the level at which informed decisions can be made so as to give Laboratory and Section Chiefs the authority for many routine personnel and procurement decisions; (2) that personnel and procurement systems should be re-engineered to be responsive to the special needs of scientific and technical work; and (3) that legal requirements for accountability can be built in without the need for bureaucratic layering. A summary of these recommendations is attached as Appendix V of this document. Since approval of most of these recommendations must await evaluation by the Department of Health and Human Services, and implementation may require far-reaching legislative changes in some cases, stop-gap measures are being designed.

Recommendation #1 (IRPs as an administrative expense): We agree that the designation of the intramural research program as an NIH administrative expense is a major impediment to efficient recruitment and promotion of talented intramural scientists, since it makes the IRP subject to FTE limitations irrespective of budget limitations, and prevents promotion of scientists to levels of GS-14 or above (comparable to Associate Professor in academic terms). Efforts to reverse this decision have so far been unsuccessful.

Recommendation #2 (Review of regulations that limit recruitment and retention): As noted above, a working group on intramural re-invention has been established, and has completed a set of far-reaching recommendations for re-invigorating the administration of the intramural program. These are outlined in Appendix V.

Recommendtions #3 and #4 (Senior Biomedical Research Service): A Senior Biomedical Research Service (SBRS) established for recruitment purposes as well as career development of senior scientists, passed by Congress in 1990, has received support of the Department of Health and Human Services, and the Office of Management and Budget has endorsed implementation while the process of rule-making is underway. A credentialling committee consisting of ICD Directors, Scientific Directors, and senior intramural scientists has been assembled by the NIH to identify candidates for the SBRS in the following priority order: (1) new recruitments; (2) retention of outstanding scientists; and (3) promotions for exceptional intramural scientists. The SBRS also includes a portable retirement system compatible with academic TIAA-CREF retirement systems. The NIH leadership is also discussing with the Veteran's Administration, the Bureau of Prisons and the Department of Defense, an extension of Title 38 authority to supplement salaries of clinical care physicians working in the Clinical Center. In order to have SBRS and Title 38 be optimally useful, authority to hire and promote at the GS-14 or above level is needed.

Recommendation #5 (Procurement, space, and personnel): The Office of Management and Budget (OMB) has backed, in principle, efforts throughout the government to improve the current procurement system as recommended by the National Performance Review. Appendix V summarizes changes in procurement that would improve the efficiency of conduct of intramural research.

To make space available for new recruitments, a subcommittee of Scientific Directors recently suggested several ways to create a NIH Director's Space Reserve. New laboratory space is expected to be available in the next 5-6 years, in association with completion of the new hospital and a new research building (building 50, which replaces buildings 2,3 and 7). In addition, space can be generated on campus by exchanging non-wet lab space (such as offices and computer facilities) in laboratory buildings for office space both on and off-campus to allow renovation of existing on-campus office space as laboratory space. Improvements in the speed with which renovations can be done will depend on acceleration of the current procurement system. Such improvements have been requested. A Master Plan for campus space is under development by the Office of Research Services, the Office of Intramural Research, and the Office of the Director, NIH, in consultation with NIH scientists and members of the local community. This plan will maintain the current size of the research force, and gradually increase research space over the next 10 years to reduce crowded conditions in the laboratories.

There will be a new emphasis on shared facilities, both within the NIH, and between intramural and extramural NIH. This was a major subject of discussion at an "NIH Leadership Forum" attended by the ICD Directors and Scientific Directors at Airlie House, Virginia, on August 30, 1994. Documentation of existing shared facilities and ideas for new sharing of facilities are being developed.

In addition to sharing facilities, a much greater effort is underway to share intellectual resources on campus. The NIH Director has fostered the establishment of NIH-wide scientific special interest groups in the areas of Cell Biology, Molecular Biology and Biochemistry, Neurobiology, Genetics, Immunology, and Clinical Sciences to complement existing special interest groups (for an inclusive list see Appendix VI). These groups are preparing directories and are sponsoring workshops, seminars, and symposia on campus to improve communication and enhance collaboration. A new Wednesday Afternoon Lecture Series, sponsored by these special interest groups with support of the NIH Director, consists of outstanding speakers from outside the NIH, followed by poster sessions by intramural scientists germane to the speaker's subject area. A new NIH Director's Seminar Series by tenure-track and recently tenured NIH scientists helps to enhance communication among our scientists. The NIH Research Festival, in which all members of the NIH community spend several days attending symposia, workshops, and poster sessions, will be continued in a new venue—the conference center in the new Natcher Building, just completed on campus. All of these activities have heightened the sense of community on campus and improved communication among NIH intramural scientists.

(5) NIH-Private Sector Collaborations

As a result of suggestions made in the EAC Report and a report from the Office of the Inspector General, a number of far-reaching changes have been initiated in the organization of the Office of Technology Transfer. Two new policy committees have been instituted: (1) The Technology Transfer Policy Board (TTPB), which acts as a focus for developing Department of Health and Human Services technology transfer policy for which the NIH is the lead agency; and (2) The Technology Transfer Advisory Committee, which establishes policy for technology transfer for the NIH intramural community. The new organizational structure for supporting technology transfer at the NIH is schematized in Appendix VII. In addition, a search has been conducted for a new Director of the Office of Technology Transfer, and the announcement of the new director should be made very soon.

Recommendation #1 (Purpose and definition of a CRADA): On July 21, and September 8, 1994, the NIH sponsored two public forums in order to solicit advice and recommendations from the biotechnology and pharmaceutical industries, the research community, and the public on issues relating to Cooperative Research and Development Agreements (CRADAs). Among the major topics discussed was the scope of research and license rights under a CRADA. Dr. Dinah Singer, Chair of the NIH CRADA Subcommittee, presented an important background paper that addressed the scope, purpose and definition of a CRADA. The invited panelists at the public forum made a number of recommendations that will be considered by the Public Health Service (PHS) Technology Transfer Policy Board (TTPB) and the Advisory Committee to the Director, NIH. Upon request, and through targeted mailings and distributions at trade conferences, NIH disseminates a background pamphlet designed to provide key information about the NIH CRADA program. In addition, in the coming months, the newly-formed PHS TTPB and the NIH Technology Transfer Advisory Committee (TTAC) will consider a number of policies related to CRADAs, including a CRADA policies and procedures manual chapter drafted by Dr. Singer and Ms. Mary Ann Guerra. Once issued it

can be expected that this document will receive the full attention of NIH's major technology transfer partners.

Recommendation #2 (Database): The NIH Office of Technology Transfer (OTT) is in the process of creating a new directory of technology transfer opportunities — "PHS Technology Transfer Directory 1994/95". Publication of this directory is scheduled for late 1994. This directory will be updated periodically, and OTT will explore the possibility of making it available on-line through the Internet.

Recommendation #3 (Dissemination of Information): The NIH OTT has recently updated, and will soon republish, practical guidlines that explain the NIH CRADA program and licensing opportunities at NIH. A key component of the dissemination plan is to distribute these materials at the numerous professional conferences attended by OTT staff and at which OTT staff members speak. In addition, these materials have been mailed to the numerous pharmaceutical and biotechnology firms on a comprehensive OTT mailing list. Further, it should be noted that the two widely-attended and widely-reported public meetings on CRADAs held, respectively, on July 21, 1994 and September 8, 1994, both involved detailed public discussions of NIH CRADA and licensing activities.

Recommendation #4 (Timely Review of CRADAs): As the External Advisors' Report notes, the average approval time for CRADAs at NIH is 10 months. NIH is aware that many potential CRADA partners cite this lengthy review process as a major impediment to collaborating with the NIH. Toward the end of reducing this review process, the NIH formed an internal committee, chaired by Dr. Ted Colburn, the Technology Development Coordinator of NIAAA, to devise recommendations for streamlining the NIH CRADA review process. These forthcoming recommendations will be considered by the NIH TTAC and the NIH CRADA Subcommittee in the next few months.

Recommendation #5 ("Letter of Intent" CRADA): Although some ICDs (e.g., NCI) aggressively promote the use of the Letter of Intent CRADAs, more work needs to be done to encourage the use of this device across the NIH. Promoting the proper usage of "Letter of Intent CRADAs" is an issue appropriate for consideration by the newly formed NIH TTAC. While Letter of Intent CRADA can expedite the beginning of research activities, it will be important to understand that this device does not guarantee the ultimate approval of a CRADA and thus will not necessarily convey any intellectual property rights created by NIH scientists in the course of this "pre-CRADA" research, should a CRADA not be consummated.

Recommendation #6 (Patent Applications): On September 23, 1994 the consulting firm of Ernst & Young submitted its "requirements analysis" to OTT for the NIH Invention Tracking System (ITS). This contract study will be of great assistance in making improvement to the ITS. In addition, transition plans have been formulated for OTT to assume the responsibility for the filing of all foreign patent applications at the beginning of calendar year 1995 when the remaining portion of this function is to be transferred from the National Technical Information Service. With respect to training NIH staff in the area of patenting, a committee is making recommendations for the consideration of the NIH TTAC to assure that all relevant NIH staff better understand their responsibilities in the areas of employee invention reporting, patenting and licensing.

Recommendation #7 (Non-exclusive Licensing of Research Tools): It is the long-standing policy of NIH to license basic research tools non-exclusively. The OTT Division of Technology Development and Transfer has been charged with reducing this into practice through a formal policy statement for consideration by the newly-formed NIH TTAC.

Recommendation #8 (Facilitate Rapid and Broad Access to Research Tools): It is recognized that the process by which research tools are licensed non-exclusively can be expedited. The OTT is in the process of developing a model to assist in the evaluation of invention reports. One important by-product of this project will be an earlier and clearer classification of the practical utility of reported inventions so that, for example, research tool applications can be quickly identified and licensed non-exclusively. It is expected that a necessary software procurement will be accomplished in the next few months so that this project can be pilot tested. On a related matter, the NIH recently published, for public comment, the Uniform Biological Materials Transfer Agreement (UBMTA) that attempts to streamline the process for sharing research materials between non-profit research organizations and is in the process of developing such an agreement for sharing materials between for-profit and non-profit organizations.

Recommendation #9 (Review of Existing CRADAs): It may be more appropriate for the newly-formed NIH TTAC to conduct this review and evaluation since the TTAC is now the body charged with advising the Director, NIH, on matters concerning the NIH technology transfer program. Accordingly, Recommendation #9 will be placed on the agenda of one of the first TTAC meetings. With respect to Recommendation #9 (1), it must be noted that the NIH CRADA program has already yielded one important therapeutic agent, taxol, and that there are several more promising products in the development

pipeline, including some nearing the final stages of approval (e.g., taxotere, Hepatitis A vaccine [already approved in Europe]).

Recommendation #10 (CRADA Meeting): Public meetings were held on July 21, 1994 and September 8, 1994 to discuss key CRADA policy issues. While the first meeting was intended to address all aspects of CRADAs, nevertheless, much of the discussion centered around the reasonable pricing clause. Because of the high level of interest in this particular issue the September 8th meeting focused solely on the pricing clause. The recommendations of the invited panelists at these meetings, which included representatives from key constituency groups, will be considered by the PHS TTPB and the Advisory Committee to the Director, NIH (this latter group is scheduled to meet December 1-2.) Once this is accomplished, Dr. Varmus will be in a position to make recommendations to the Assistant Secretary for Health.

(6) Process for Allocating Funds Between the Extramural and Intramural Programs

As noted by the EAC Report, there is no single formula by which to determine the appropriate distribution of funding between the intramural and extramural efforts of an individual ICD The current distributions of ERP and IRP funding reflect scientific needs and opportunities, Congressional mandates, existing investments in personnel and resources, and historical trends. The conclusion of the EAC Report that the IRP budget should be determined through a rational planning process is endorsed by the current NIH leadership. However, many of the recommendations made by the EAC involve the detailed management of individual ICD budgets, a situation which is not consonant with Congressional directives delegating budget authority to the ICD Directors, nor with the trust that has been developed between the OD and the ICD Directors. Efforts to enhance this collegiality while providing leadership and oversight related to the recommendations follows:

Recommendation #1 (Annual planning process): All of the ICDs currently have an annual process for determining their IRP budget, although this is not a formal process in all cases. As a result of the EAC Report, ICDs have been strongly encouraged to develop more formal planning processes. The more stringent review process by the Boards of Scientific Counselors described in the revised guidelines (Manual Chapter #3005, Appendix II) should make it possible to trim back or eliminate support for non-productive, non-innovative research activities in the IRP. The resulting resources can then be allocated to the ERP or to other components for new initiatives in the IRP, depending on a rigorous evaluation conducted by the ICD Director as to where such resources would better be directed. It is unlikely that all resources will remain in the IRP since current administrative restrictions are forcing the downsizing of the NIH workforce (by 15% of FTEs) with a concurrent loss of the funds that can be used intramurally.

Recommendation #2 (Committee chaired by NIH Director): The unit best equipped to judge programmatic and scientific needs within an ICD is the Office of the Director of that ICD after consultation with the ICD's National Advisory Council. However, the NIH Director may encourage outside review of utilization of IRP resources from time to time as the need becomes apparent. For example, a blue ribbon panel was recently constituted as a subcommittee of the National Cancer Advisory Board (NCAB), to examine the "structure and function" of the NCI's IRP. This panel will be making its recommendations to the NCAB by the spring of 1995.

Recommendation #3 (Annual IRP budget estimates): These estimates are currently provided by the ICD's to the Office of the Director, NIH. In instances in which these budgets do not appropriately reflect the relative productivity of the IRP and ERP of a particular ICD, requests will be made to provide the justification on which these funding decisions were made.

Recommendation #4 (NIH Director's 5% transfer authority between the IRP and ERP of an ICD): Under current law, the NIH Director does not have this direct authority, since appropriations are made to individual ICDs and ICD Directors are charged with formulating their budgets. However, the FY 1994 NIH appropriations bill does include a 1% transfer authority among various ICD appropriations. In principle, this authority could be used to transfer funds into the IRP or ERP of an ICD, thereby changing the relative balance of the two programs.

Recommendation #5 (Evaluation of ICD Directors based on formal programs for IRP/ERP allocations): The annual evaluation of ICD Directors by the NIH Director is based primarily on the stewardship of public monies appropriated by the Congress. An important component of this performance is the appropriate distribution of resources, particularly, between the IRP and ERP.

Recommendation #6 (Description of formal review process for IRP/ERP allocations): ICDs will be asked to provide a written description of the process by which budget allocations between their IRP's and ERP's are made by January 1, 1995. Those processes will be reviewed and guided by the NIH Director.

Recommendation #7 (IRP budget not to exceed 11.3% of total NIH budget): The NIH FY1994 budget for the IRP is estimated at 10.9% of the total budget, and the projected budget for FY 1995 is estimated to be 10.9%. These figures are based on a 3% budget increase for the intramural program (below inflationary increases) and a 4.2% increase for the NIH budget as a whole (keeping pace with inflation).

(7) Renewal of the Clinical Center

The EAC recommended a phased program for renewal of the Clinical Center as a 250 bed hospital with essential associated laboratory space. This program has been initiated as indicated in the responses to the specific recommendations.

Recommendation #1 (250 bed hospital): The NIH has received support from the Secretary of DHHS to proceed with planning for a 250 bed in-patient hospital with adequate day hospital space, adjacent to the existing Clinical Center, that will meet the future NIH requirements for clinical research. The new hospital will contain laboratory space for the scientists, currently in Building 10, who need to be immediately adjacent to the nursing units. $2.5M has been set aside for FY '95 and funds have been requested for FY '96 to initiate planning and construction of such a facility.

Recommendation #2 (Associated laboratory space): An analysis of the recommendations of the individual ICDs regarding the need for space adjacent to wards in the new hospital facility has been completed. It has been judged appropriate that 12-15 percent (approximately 250,000 sq ft) of the laboratory space currently available in Building 10 should be adjacent to the patient care units. This space would satisfy the scientific needs of the ICDs and also provide swing space for possible future renovations of the laboratory space in Building 10, if such are deemed feasible.

Recommendation #3 (Renovation of Clinical Center): After the new hospital and laboratory space are occupied, if funds are available, if the scientific need exists, and if it is technically feasible, one possible plan will be to perform a systematic renovation of Building 10, converting it into a modern laboratory facility and allowing for phased renovation of laboratory space not included in new construction.

Recommendation #4 (Clinical protocol review): A policy has been approved by the Medical Board, Scientific Directors, and ICD Directors that will assure prospective and retrospective review of all research protocols, including the scientific and clinical merit of the studies, the costs and patient accruals. This has been codified as Manual Transmittal M94-12 entitled "Protocol Cost and Performance", which is attached as Appendix VIII.

Recommendation #5 (Funding from intramural program): Neither extramural funding nor quality intramural programs will be reduced to fund the renewal of the Clinical Center. Several reprogramming mechanisms will be pursued to mobilize funds for the Clinical Center renewal.

Recommendation #6 (ICD maintenance and renovation budgets): The Clinical Center administration will review the status of facilities throughout Building 10 and, for ICD occupied space, provide a list of common space requiring upgrades. ICDs will develop their individual plans for renovation of their existing space.

Recommendation #7 (Use of new laboratory space): The NIH Director needs a reserve of laboratory space for new initiatives and agrees with the need to return off-campus scientific programs to the Bethesda campus. In the long term, as a result of the Clinical Center renewal and the upgrade of Building 10, some space may become available for these purposes. However, this space will not become available until after the project is completed, and because of the uncertainties of timing, this is not a solution to the requirement to identify a NIH Director's space reserve as soon as possible.

The DDIR convened a subcommittee of Scientific Directors to make recommendations concerning the establishment of an NIH Director's Space Reserve. One of the recommendations of this committee was that non-wet laboratory space, currently in laboratory buildings, be relocated so that new laboratory space could be created as soon as possible.

The first step in the Clinical Center renewal project is to consolidate existing patient care units in Building 10 and to reduce the Clinical Center beds to approximate the envelope of the new hospital (about 250). This consolidation will result in closure of four patient care units in Building 10 and free up about 19,000 net sq. ft. for purposes other than patient care. Creative use of such space, along with renovations, will generate about 15,000 sq ft of "new" laboratory space in Building 10. This will become an interim NIH Director's reserve, pending the completion of the new hospital and subsequent renovation of Building 10.

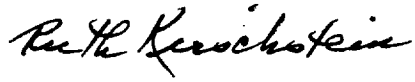
Conclusions and Acknowledgments

The Intramural Research Programs (IRPs) of the NIH have contributed in a major way to the success of bio-

medical research in the United States (see Appendix IX of this report for a description of the history and status of the IRPs prior to the final implementation of the EAC report).

As detailed in this "Implementation Plan and Progress Report", major changes have occurred in the IRPs of the NIH in response to the report of the External Advisory Committee, and many more are planned or in progress. These changes will help guarantee the continued excellence of the IRP during a time of constrained resources. The willingness of the EAC members, the NIH Internal Working Group, the NIH Scientific Directors, the NIH ICD Directors, and other NIH senior and support staff to devote their time and talent to the review of the IRPs reflects the commitment of these individuals to the most efficient use of the public investment in improved prevention, treatment and cure of disease. We are grateful for all their efforts, and are dedicated to implementing the appropriate changes needed to sustain this valued component of the nation's biomedical research effort.

Harold Varmus, M.D.
Director, NIH



Ruth Kirschstein, M.D
Deputy Director, NIH

Michael Gottesman, M.D.
Deputy Director for
Intramural Research

APPENDICES