# A Healthy NIH Intramural Program: Structural Change or Administrative Remedies? Report of a Study

Institute of Medicine, Division of Health Sciences Policy

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# A Healthy NIH Intramural Program

## Structural Change or Administrative Remedies?

Report of a Study by a Committee of the Institute of Medicine
Division of Health Sciences Policy

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

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

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# INSTITUTE OF MEDICINE

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# ACKNOWLEDGEMENTS

The committee appreciates the cooperation and assistance it received from many individuals and organizations. Space prevents acknowledging them all, although every input contributed to the overall report. A few warrant special mention.

More than 50 organizations and individuals (Appendix A) provided testimony to the committee regarding the NIH Intramural Program within a very brief timeframe; we offer them each our thanks.

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Committee to Study Strategies to Strengthen the Scientific Excellence of the NIH Intramural Research Program

# SUMMARY

This study was prompted by a the concern, on the part of some, that the National Institutes of Health (NIH) intramural research program, for many years a distinguished component of the nation's effort in biomedical science, is experiencing difficulties in attracting and retaining outstanding basic scientists and clinical investigators. This concern becomes focused from time to time on the loss of particular senior investigators, but more important to the future vigor of the program is its continuing capacity for renewal at all ranks.

The recruitment and retention problems are generally attributed to relatively low pay, non-competitive fringe benefits and other constraints of a government agency. The Office of Management and Budget (OMB) and NIH entered into a dialogue about whether solutions to these problems could be found within government, or whether placing the intramural program in the private sector would provide the most expeditious and comprehensive solution. Seeking advice on these questions, the Secretary of the Department of Health and Human Services (DHHS) asked the Institute of Medicine (IOM) to conduct a study of ways to ensure the continued scientific excellence of the intramural laboratories.

Solutions were to be sought among a wide range of organizational options. Upon close examination of the situation, the IOM study committee came to the following principal conclusions:

- The intramural program has made and continues to make invaluable contributions to our knowledge and understanding of basic biological processes and their dysfunction in disease.
- A high quality intramural program is a distinctive and valuable component of the nation's overall biomedical research effort.
- The quality of the program, however, varies by scientific sub-field. To improve the overall quality and maintain the excellence and credibility of the program, attention must be paid to a continuing process of quality review and how it can be used to improve the allocation of resources.
- The nature and severity of recruitment and retention problems do not call for major structural reorganization of the program. Removal from the public sector or significant structural reconfiguration were found to be either incompatible with the purposes of the program or likely to cause greater disruption than would be warranted by the

possible benefits. Privatization, in the sense of making the intramural program free-standing and self-supporting, is undesirable and impractical.

- It is desirable to increase NIH's flexibility in pay and personnel administration so that it may compete more effectively for people critical to the continued success of the various programs, and otherwise to administer more effectively its public responsibilities.
- The scientific directors of the institutes, who most directly manage the intramural program, are essential keys to their success. Therefore, finding ways to ensure the selection and retention of distinguished scientific leaders for these posts is essential.
- The federated structure of NIH has served the nation's biomedical research efforts well. However, at times this structure impairs coordinated actions across institute lines and the ability to respond with efficiency to new challenges and responsibilities. Rather than create a new pattern of authority, the committee recommends the creation of a modest discretionary fund under the control of the Director of NIH. In addition, the Director of NIH should be given the authority to make decisions on personnel, travel, and space that are currently made at higher levels of DHHS.

## MISSION OF THE INTRAMURAL PROGRAM

As a government laboratory, the intramural program has multiple roles in support of the NIH mission of improving the health of the nation through biomedical research. The program's activities include basic research, clinical research, training scientists, communicating research findings, developing policies on biomedical research priorities, and translating research findings into more effective medical care. It has the capacity to respond to national health emergencies. The Clinical Center is one of the important features that differentiates the intramural program from other research settings.

No single element of the intramural program is literally unique. But the aggregation of elements—for example, research laboratories, a clinical center, freedom from competitive grant renewals, disease-related institutes—forms a distinctive environment. Further, the intramural program is a visible focus and rallying point for the nation's overall biomedical research effort.

The success of the extramural program notwithstanding, growth in other venues of research have left the intramural program, despite its continuing high quality, with a less dominant role in some areas of U.S.

biomedical research than it once had. The committee believes this is a sign of health in U.S. biomedical science and does not detract from the continuing need for a strong government laboratory focused on biomedical research. Moreover, the NIH intramural program has created an atmosphere that many researchers believe is unparalleled.

## FINDINGS

### The Question of Privatization

In recent years, a wide range of government functions has been scrutinized for the potential of shifting them to the private sector. Proponents of privatization have argued that in certain circumstances it allows goods and services of the same or better quality to be delivered at lover cost. This reasoning is behind the question of privatizing the NIH intramural program.

It is important not to confuse the scope of public sector activities with the scope of government responsibilities. The government can retain responsibility for biomedical research, for example, but arrange for those activities to be carried out in the private sector—which is the way NIH currently spends about 85 percent of its budget. The committee evaluated the advantages and disadvantages of having the remaining small share of the NIH budget represented by intramural research activities administered under any of several forms of privatization.

The committee analysis of the proposal to privatize the intramural program focused on privatization as a means of revitalizing the program rather than as a way of diminishing government responsibility and expenditures. Some forms of privatization were found to be clearly unattainable for the intramural program because, given the nature of its product, principally basic and clinical research, it cannot generate enough revenues through user fees or the sale of services to support its activities. Other forms of privatization, such as creating a private free-standing research institute, either would not be more effective than the current organization or would destroy an important element of the program, such as the relationship between intramural and extramural research. The committee concluded that none of the common forms of privatization would be as likely to sustain the vitality of the research effort as would a more modest restructuring of certain aspects of the current organization. Some changes, however, are absolutely necessary if the program is to continue to be an important component of the nation's biomedical research effort.

### Administrative Problems

As a government agency, NIH operates within a number of administrative constraints, some of which hinder managers' efforts to make the most effective use of public resources. The committee reviewed aspects of the compensation and personnel system, travel authorizations, procurement procedures, and the development and management of new and renovated space.

The topic that has received the most attention is the issue of lower pay for NIH scientists compared with those in universities or other biomedical research centers. The committee finds that there is merit in the claim that an unfavorable pay disparity exists and is growing. It is, however, possible to overstate the magnitude of this problem. Careful examination of data (making appropriate job comparisons), compel a more tempered argument than has commonly been made to support the case that NIH needs relief from salary restrictions. For example, the average medical school chairman of internal medicine—the most common NIH specialty—receives a base pay 70 percent above the top federal salary. However, for Ph.D.s below the Senior Executive Service level, NIH salaries are competitive. The impact of the pay differential is especially felt in attempts to retain and hire physician scientists and the highest level basic scientists, who may command salaries far above the federal pay ceiling. The impact is also felt in some personnel categories, such as nursing and allied health, for whom federal salaries often lag behind local pay scales. The problem stems at least as much from lack of flexibility to adjust compensation in response to changing market conditions, as from relatively low pay across the board. Therefore, the committee finds that there are circumstances in which salary restrictions should be lifted to enable NIH to compete for personnel in high demand and those individuals who are crucial to the well-being of the intramural program.

There is evidence that many good scientists are willing to forego higher earnings to enjoy the distinctive research environment at NIH, which for some is especially conducive to research productivity and creativity. But some of the factors that contribute to this environment are increasingly subject to counterproductive administrative controls. Notable among these are travel, support personnel, equipment, and space procurement. The combination of increasingly burdensome and unnecessary constraints along with lower salaries and less flexible administrative policies creates justified concern about NIH's ability to continue its past successes in building the staff necessary to sustain the quality and vitality of the intramural program.

## Quality of the Intramural Program

The committee believes that unless the quality of research in the intramural program is excellent, the investment of the government is not justified. The problems of measuring quality of scientific institutions are well known. The committee used several indicators of quality, such as citation analysis and a review of notable achievements. It also examined quality assurance mechanisms. These indicators suggest that no serious decline in quality has occurred in one of our nation's most important centers of biomedical research.

One can identify many investigators who are among the most respected in their fields. However, not all work in the intramural program meets the same high standards. This variability perhaps is to be expected in any research organization of the size and scope of the intramural program. The committee was unable to determine the extent to which notable scientists mask a cadre of less productive scientists. Nevertheless, it is the committee's judgment that further improvements in the quality of the program are essential and attainable.

There has been long-standing concern in the biomedical community that the review process for the intramural research program lacks the rigor of the competitive peer review process of the extramural program. Although in recent years NIH has taken action to improve this process, inadequacies remain in the appointment process and the degree to which recommendations of the Board of Scientific Counselors are given serious consideration. The committee believes it is particularly important that accountability to a disinterested body, external to the intramural program and institutes, has oversight responsibility to ensure the integrity of the review process. The committee does not recommend that the intramural program adopt the procedures by which the extramural competitive grants are evaluated. But, a more credible and independent peer review system—suitable for the environment—is essential to sustain the future vitality of the intramural program. This is a key step in ensuring the most effective use of the resources invested in the program.

A rigorous review process is necessary but not sufficient to sustain quality. Under the leadership of the institute director, the scientific director of each institute is key to the success of the intramural program, providing both intellectual and administrative leadership. Not only do scientific directors control resources, but, less tangibly, they are responsible for the spirit and morale of the institute.

The committee believes that the qualities of demonstrated scientific achievement, leadership, and administrative ability that are needed for this position are rare commodities. To attract people of sufficient stature requires that a premium be paid.

In order to get a sense of what the future might hold for the intramural program, the committee sought to evaluate the young postdoctoral and junior-level personnel with whom rest much of the future of the organization. The quality of postdoctoral fellows cannot be measured precisely, but there is a widespread perception that the program does not attract the caliber of trainees characteristic of former years. Intensified competition from universities and industry, and the end of the doctor draft which provided an incentive for young scientists to compete for a place at NIH, are the most frequent causes cited for this perception.

## RECOMMENDATIONS

The committee believes that it is possible to address many of the identified administrative problems without making radical changes in the structure or organizational location of NIH.

### Increased Flexibility in Personnel Administration

Believing that the scientific leaders of NIH need greater flexibility to be successful in competitive labor markets, the committee recommends that Congress authorize NIH to develop and implement a personnel demonstration project tailored to overcome the deficiencies of the current system.

The project should feature:

- a simplified hiring classification and pay administration authority similar to a demonstration now being conducted by the National Institute of Standards and Technology.
- an occupation-specific pay standard based on surveys of market comparability
- the ability to exceed the federal pay ceiling in justifiable circumstances
- portable retirement benefits to make transfer between non-federal employment and the NIH less disadvantageous
- employment ceilings replaced by a personnel expenditure budget.

The committee arrived at the above recommendations after examining a variety of government organizations that are used to carry out public functions. It found that no single model would effectively solve the principal administrative problems that NIH faces, and that all such changes carry associated risks that seem greater than the anticipated benefits. The committee understands that the problems of NIH are far from unique. In theory, it would be desirable to resolve certain government-wide problems by strengthening the attractions of public service. Several past and present commissions have investigated such across-the-board solutions. However, individual agencies unable to wait for help through such general reforms have turned to remedies for their own specific problems. The committee does not think it advisable to wait for civil service reform; therefore, it focuses on specific strategies designed to remedy some of the problems facing the intramural program. The committee has drawn on the experience of other commissions and existing experiments.

[1]Formerly the National Bureau of Standards.

### Endowed Chairs for Distinguished Scientists

Even with authority to increase compensation flexibility, NIH would find it advantageous to be able to appoint a very limited number of distinguished scientists to positions outside the federal civil service system. This would enable NIH to provide competitive salaries substantially higher than the federal civil service ceiling and other resources such as equipment, travel expenses, and technical support staff. A mechanism is needed by which NIH could establish privately endowed chairs with a term appointment for up to ten persons on the campus. Therefore, the committee recommends that Congress charter a foundation to permit the private support of up to ten endowed chairs for distinguished investigators. The creation of a foundation, similar to those established for other federal agencies such as Uniformed Services University of the Health Sciences (USUHS) and the National Park Service would be helpful. A few exceptional people added to the senior level would enhance the ability of NIH to attract superior researchers at all levels. Appropriate mechanisms would have to be put in place to prevent any appearance of conflict of interest on the part of those contributing to the endowment of such a chair.

### Maintaining an Administratively Efficient NIH

Recognizing that personnel and compensation administration are not the only administrative problems, the committee questioned whether problems articulated by NIH regarding full-time equivalent ceilings, travel ceilings, procurement and space are the result of its location within DHHS. All of these problems, with the exception of travel ceilings, originate outside of DHHS in laws and regulations enforced by agencies such as OMB and General Services Administration (GSA). The committee found that although these problems were exacerbated by the administrative layering in DHHS, they were not sufficiently serious to warrant removal of NIH from DHHS or the Public Health Service. Moreover, the scope of this study could not include an assessment of the impact of such actions on the other health components of DHHS or the NIH extramural program.

Nonetheless, these restrictions are serious irritants that weaken the management capabilities of the Director of NIH. The committee believes that efforts to micromanage NIH from the Office of the Secretary or Assistant Secretary for Health are counterproductive and cause NIH to be inefficient in carrying out its mission.

Therefore, the committee recommends that the Secretary of the Department of Health and Human Services delegate to the Director of NIH the authority to make decisions on administrative matters without being subject to review by the Office of the Assistant Secretary for Health.

Assistant Secretaries for Health have not always taken responsibility for detailed administrative oversight for NIH. From the perspective of this examination of the intramural program, broad policy guidance and interagency coordination are more valuable activities than the detailed administrative oversight that could be performed more efficiently if NIH were given greater latitude in decision making.

## Director's Discretionary Fund

The NIH is a confederation of separate entities. As such it cannot always respond well to new issues, emergencies, or research opportunities that do not clearly fall within the scope of one institute or another. In these circumstances the Director needs the resources to initiate activities across institute lines, without imposing on the independence of the institutes. Therefore, the committee recommends that Congress appropriate annually to the Director of NIH an amount no less than $25 million to be used to address emerging issues and special inter-institute research opportunities.

## Improving the Review of the Intramural Program

Several of the committee's recommendations are designed to maintain high scientific standards. Recommendations to give NIH managers the necessary flexibility to compete for personnel and provide a productive work environment are clearly intended to enhance the intellectual capital of the program. The committee believes, however, that disinterested review of the intramural research programs and assurance of implementation of reasonable recommendations also is essential to credible quality assurance.

Two recommendations address the review and resource allocation process. A panel chaired by a member of the NIH Director's Advisory Committee should be established to monitor the intramural research program review. The functions of this panel would be to oversee the integrity of the process, while taking care not to replicate the activities of the Boards of Scientific Counselors. Rather, its oversight should focus on areas that are most vulnerable to criticism, namely the selection of the reviewers and the appropriate response to recommendations.

Each of the scientific directors and their intramural programs should be reviewed as a whole every four years by an external group. The review report should be submitted to the director of the relevant institute, the NIH Deputy Director for Intramural Research, the Director of NIH. and the Director's Advisory Committee. The committee believes such a review to be necessary because of the importance of ensuring the vitality of the intramural program. The intent of the periodic review is not to limit arbitrarily the term of the scientific director, but rather to put in place a process that will ensure vigorous leadership. The responsibility of the scientific director requires having the scientific vision needed to allocate intramural resources productively, as well as function as a highly skilled manager. To recruit and retain scientists with this extraordinary set of attributes, the committee recommends that those holding the position of scientific director receive additional compensation. This will become possible under the recommended personnel demonstration program.

## An NIH Scholars Program

A major barrier for scientific directors trying to maintain a flow of fresh ideas into their programs is difficulty in recruiting highly talented scientists at the assistant professor level who would then have an opportunity to pursue their own research initiatives. To date, most tenured scientists have been promoted from the pool of postdoctoral fellows within the intramural program. To help the scientific director overcome the tendency toward excessive inbreeding, the committee recommends that Congress authorize and appropriate funds for 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 intramural program.

The program would possess several features that would make it as attractive as other prestigious appointments now available in academic institutions. As many as six scholars per year could be offered appointments as independent basic or clinical researchers. Each institute could propose up to three candidates per year. To support each scholar and associated research needs, a sum of $1.5 million over the six years should be allocated. The Director should be responsible for establishing procedures for selecting scholars.

It is anticipated that some of these scientists will remain at NIH following the 6-year term, thereby increasing the pool from which NIH leadership is selected. It is also expected that some of these scholars will take positions of leadership outside NIH—furthering NIH's traditional role of seeding the extramural research community.

In sum, the committee has rejected adoption of a major new organizational structure for the intramural program. Rather, it has recommended a program of reforms that provides NIH with the tools necessary to address problems with minimal disruption to a successful enterprise.

# INTRODUCTION

This study addresses a concern, on the part of some, that the intramural program of the National Institutes of Health (NIH), for many years a distinguished component of the nation's biomedical research effort, faces growing difficulties in attracting and retaining the strong cohort of basic biomedical scientists and clinical investigators needed to ensure continued excellence in research. This concern is often focused on the loss of senior investigators, but similar questions are raised about scientists at more junior levels. There are fears that difficulties in recruiting the outstanding senior scientists whose presence draw junior investigators to NIH may undermine the future vigor of the program.

## THE CHARGE TO THE COMMITTEE

The Office of Management and Budget (OMB) requested the Secretary of the Department of Health and Human Services (DHHS) to contract with the National Academy of Sciences, Institute of Medicine (IOM), for a study to evaluate strategies to promote the continued excellence of the NIH intramural laboratories. It was explicitly requested that this study should not confine itself to the question of privatization—a question that had caught the attention of the media and the scientific community.

The charge to the committee was to examine the role of the NIH intramural research program in the nation's biomedical research enterprise. The committee was asked to determine which characteristics of the program made important contributions that enabled it to accomplish its role and that distinguish it from other biomedical research institutions.

The committee was also asked to examine evidence to determine whether scientific excellence of the program is declining, and what factors might cause it to do so. They were further charged with an examination of alternative approaches to strengthening the program, and were asked to make recommendations that would help sustain the quality of research in the intramural laboratories in the context of changes in the external research environment.

## THE COMMITTEE'S INTERPRETATION OF THEIR CHARGE

The committee found its charge, as expressed by DHHS, to be well structured. It is important to review the mission or role of the intramural program in the context of the national biomedical research effort to determine whether the program continues to play an appropriate role or whether a change of direction is needed (Chapter 1). Similarly, the committee believes that it is important to discover whether governmental constraints were interfering with the ability of the intramural program's mission of conducting the highest quality biomedical research (Chapter 2).

The committee has adopted a broad approach to identifying the nature and magnitude of the problems facing the intramural program. In exploring these problems, the committee sought to understand their causes and potential long range effects (Chapter 3). In evaluating alternative solutions to problems, the committee weighed the severity of problems against the risks and advantages of each solution, seeking to ensure that recommendations were targeted to identified problems, while minimizing possible negative side effects (Chapter 4).

It was clear that an examination of a wide range of solutions, including but not confined to privatization, was needed. The committee, therefore, reviewed the advantages and disadvantages of making modest changes in specific administrative problems, as well as the advantages and disadvantages of various types of fundamental organizational restructuring that might offer the promise of greater overall administrative flexibility.

In its recommendations, the committee has tried to move beyond the present to identify future roles for the intramural program, to anticipate future problems, and to recommend solutions with long term validity.

## SCOPE OF THE STUDY

In defining the scope of the study, the committee was aware of the limitations imposed by its six-month study period. The principle question addressed is whether a structural change of NIH is needed to solve personnel and other administrative problems that may be interfering with the quality or mission of the intramural program. The committee looked at the mission and quality of the program from the purview of the intramural program. Readers should therefore understand the limitations of a study that did not specifically explore issues surrounding changes in the extramural program, the relationship of NIH as a whole to other agencies in the DHHS, and questions of the distribution of authority and responsibility between the Director of NIH and the directors of the institutes.

In addition, the committee concluded that it was beyond the scope of its charge to determine the optimal size of the intramural program in relation to the nation's total biomedical research effort. This study, therefore, does not include analysis or recommendations concerning the desirability of transferring resources from one element of the nation's biomedical research program to another.

Finally, the committee did not view its charge as developing solutions to government-wide personnel problems, which other national commissions are currently investigating. Nevertheless, the committee recognized that it was important to be aware that NIH is not alone in facing problems common to government organizations. Recommendations that would ask for unprecedented freedom from bureaucratic constraints would require that a sound case be made for unique treatment.

## CONDUCT OF THE STUDY

During the course of the study the committee held three meetings to address the questions posed in its charge. The committee conducted additional activities to obtain information from many individuals and organizations. On June 13, 1988, the committee held a public hearing at the National Academy of Sciences in Washington, D.C. limitations were extended to groups concerned with various aspects of biomedical research and health. Approximately 60 people attended the hearing, at which representatives of various organizations and associations addressed the committee. Additionally, the committee received written comments from more than 50 organizations and individuals regarding the NIH intramural program (Appendix A).

To hear the concerns of the community of scientists at NIH, the committee held a meeting at the NIH campus in Bethesda, Maryland on May 25, which was attended by scientists of all levels of seniority (Appendix B). Less formally, staff and individual committee members held discussions with a wide array of persons from industry, academia, professional associations, and other organizations with interest in, or valuable views or information on, the issues addressed by the committee.

In addition, the committee commissioned background papers to provide in-depth analyses of topics of particular interest. To broaden their understanding of the structural changes that the committee wished to consider as possible solutions to identified problems, the committee sought advice from the National Academy of Public Administration (NAPA). This organization has advised many agencies on matters relating to structural change. Its advice to the committee was reviewed by a panel of experts assembled for that purpose by NAPA.

Yet another source of data was NIH itself, which provided extensive information concerning structure, operations, and procedures.

Finally, because of the severe time constraints of a study limited to six months, the committee could not conduct independent evaluations of some important issues such as the tenure selection process, the quality of postdoctoral fellows, the procurement system, the physical plant, and the work of the laboratories.

## ORIGINS OF THE STUDY

The concerns that stimulated the OMB and NIH to request this study are hardly new. More than 35 years ago, when NIH employed 2,600 people, ran 7 sets of laboratories, and was building the Clinical Center, the Director of NIH and the Chief of the Research Planning Board noted the following concerns about the intramural program:

> Apart from those matters that are of common concern to research administrators in industry, universities, and government, some problems are either unique to government, or appear to be particularly important in government. Federal salary scales are not high. In general, most surveys show that federal pay scales are roughly comparable with industrial scales in the lover and middle bracket. Outstanding people, however, are paid much less than they could earn in private industry (Sebrell and Kidd, 1952).

The authors add that the Civil Service Commission had helped NIH bypass some bureaucratic features of civil service recruitment and compensation, but that rewarding outstanding investigators without moving them into administration remained a problem.

These observations touch on a number of topics that resonate today, and that have been the continued focus of investigations and reports over the years. Two of these bear highlighting:

- Concern over non-competitive civil service pay and the difficulty of attracting experienced physicians, scientists, nurses, and allied health professionals.
- Concerns over unnecessary bureaucratic constraints, which are heightened by beliefs that the special nature of scientific work makes inappropriate a civil service, bureaucratic approach to the management of personnel and work environment.

Many of the problems identified in the NIH intramural program are shared with other governmental agencies. Some are particularly acute for the science-based efforts of agencies, and especially acute for NIH, whose primary mission is the conduct of basic and clinical research. There are, however, indications that problems identified by earlier commissions and committees have became more acute in recent years. The following list describes some current concerns and their causes.

- Micromanagement by the parent department: officials are often reluctant to delegate administrative authority and seek to control programs in inappropriate detail. At NIH, this is observable in many ways, including the requirements that the Office of the Secretary of DHHS approve senior appointments and bonuses, and that the Office of the Chief of Staff of DHHS approve foreign travel.

- Compensation of personnel: the federal system imposes rigidities and limitations on pay and benefits. The original pay comparability objectives of the government have been eroded, making it more difficult for NIH and other agencies to compete for some categories of personnel, notably high level research scientists and scientific managers.
- Merit recognition: the prevailing federal payment system is frequently criticized as providing little opportunity to recognize individual abilities and outstanding accomplishment. In addition, managers at NIH and other agencies with scientific personnel note that performance measures are better suited to appraising the work of administrative, rather than scientific, personnel.
- Retirement statutes: federal retirement plans that cannot be completely interchanged with private sector retirement plans create a disincentive for potential mid- and late-career recruits to become federal employees at NIH.
- New appointments: delays in securing approval from the Office of Personnel Management for new appointments in the competitive civil service cause agencies, including NIH, to lose promising recruits to more flexible employers.
- Personnel ceilings: imposing personnel ceilings, in addition to overall budget constraints, makes little management sense in most agencies. NIH managers feel they would be more effective if they could allocate their financial resources in ways they determine as best fulfilling their agency's mission.
- Contracting out and procurement: over the years, federal acquisition regulations and controlling statutes have became more onerous—often as a response to perceptions of bad or fraudulent management. While understanding the need for fiscal responsibility, scientists are anxious to preserve a procurement process that is responsive to the needs of biomedical research.

Numerous groups have analyzed these and other problems and have made recommendations. Some that have addressed problems of civil service pay and reform include the Hoover Commission, the Civil Service Reform Act of 1978, and currently the National Commission on the Public Service, under the chairmanship of Paul Volker. Government laboratories have been the focus of some investigations such as the White House Science Council Report of the Federal Laboratory Review Panel (U.S. Office of Science and Technology Policy, 1983), and NIH, specifically, has been the focus of attention of other groups, such as the report of the President's Biomedical Research Panel (1976), the Institute of Medicine (1984), and self-examinations by NIH. Recommendations made by such groups, of which only the first has been implemented, include:

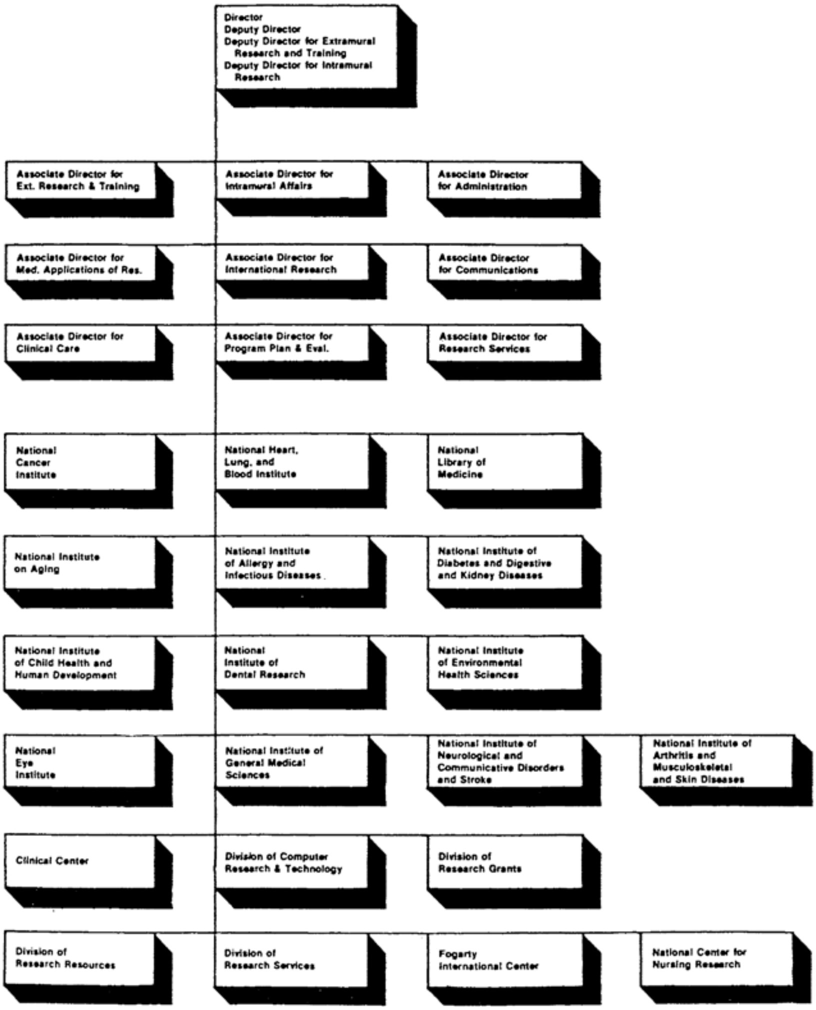
- Establishment of Senior Executive Service, 1978.
- Proposed pay increases for Levels I through V of the Executive Branch, ranging from approximately 50 to 80 percent (Report of the Commission on Executive, Legislative, and Judicial Salaries, 1986).
- Creation of a scientific/technical personnel system independent of current civil service system (U.S. Office of Science and Technology Policy, 1983).
- Creation of a Senior Biomedical Research Service, with supplemental pay up to 110 percent of Executive Level I, and allowance of transfer of participation in the Teachers Insurance Annuity Association-College Retirement Equities Fund (TIAA-CREF) for recruits from universities (NIH, 1987).

The ultimate concern of all these studies has been to enable agencies to accomplish their missions more effectively. Superior staff, responsible oversight, and freedom from micromanagement, are generally deemed necessary to achieve this goal.

## STRUCTURE AND FUNDING OF NIH AND ITS INTRAMURAL PROGRAM

NIH is currently composed of the Office of the Director, twelve research institutes, one research center (National Center for Nursing Research), the Fogarty International Center (which facilitates international research collaboration), the Clinical Center (a research hospital and laboratory complex where the research institutes have allocated beds), the Division of Research Grants (which administers the scientific review of extramural grants), three service divisions (Computer Research and Technology, Research Resources, and Research Services), and the National Library of Medicine (Figure I-1).

FIGURE I-1 NIH Organizational Chart




SOURCE: NIH, 1987

As the organizational chart indicates, the Office of the Director of NIH includes deputies for the principal functions of NIH—extramural research and training, and intramural research. The Director of NIH receives recommendations from the Advisory Committee to the Director of NIH, whose members are appointed by the Secretary of DHHS. This group meets twice a year and is also charged with advising the Secretary and the Assistant Secretary of DHHS on matters concerning NIH.

NIH grew from a $3 million enterprise, immediately after World War II, to an organization with a budget today of over $6 billion. Appropriations for NIH grew rapidly in the immediate post-war years. In 1948, a rapid period of growth of new institutes began with the establishment of the National Heart Institute and the National Institute of Dental Research. The growth of categorical institutes was, in part, the result of lobbying by outside groups—voluntary health associations and professional scientific societies. During the mid-1950s, NIH Director James Shannon developed a close relationship with congressional leadership and rapid expansion occurred, continuing into the 1960s. The budget passed the $1 billion mark in 1966, doubled in the following six years, and after a pause in the early 1970s, reached $4 billion in 1983.

The organizational concept of the institutes does not follow a consistent pattern—some are disease related (cancer, diabetes, etc.), some are organ related (heart, lung, eye, etc.), while others are related to fields of science (general medical, environmental health, etc.). The study sections that provide peer review of extramural grants are structured by science fields and, therefore, usually review grants for more than one institute because of overlap of science among institutes (Morris, 1984).

Typically, each institute is under the oversight of its own advisory council whose membership is drawn from outside NIH. This council approves all extramural grants, reviews the institutes' programs, and advises institute and NIH directors and the Secretary and Assistant Secretary of DHHS. Each institute has an extramural and intramural program headed by a director whose office resembles that of the Director of NIH—containing an office of administration, program planning and evaluation, communications, and other functions.* Institute directors control the policies and programs of their institute (Morris, 1984). Scientific directors supervise and shape the intramural research program, play important roles in assessing the performance of the intramural laboratories in their institutes, act to address problems in the working environment, and serve as a conduit for the scientific advice from intramural investigators to

*The NIGMS has a small, but unique, intramural research program formally known as the Pharmacology Research Associate Training (PRAT) Program. Under its auspices, a group of young scientists is selected each year for a 2-year period of postdoctoral research under the tutelage of preceptors in the laboratories of the various categorical institutes of the National Institutes of Health and the Alcohol, Drug Abuse, and Mental Health Administration.

government decision-makers. Each research institute, the National Center for Nursing Research, the Division of Research Resources, the Fogarty Center, and the National Library of Medicine receive individual annual congressional appropriations, and their activities are closely monitored by congressional authorizing and appropriating committees, as well as by interest groups and professional associations.

The National Cancer Act of 1971, in replacing the original 1937 authority, established some characteristics that distinguish the National Cancer Institute (NCI) from other institutes in the following ways:

- Giving the NCI bureau status enabled the institute to create its four divisions. The divisions represent major program elements—biology and diagnosis, etiology, prevention and control, and treatment. Each division is headed by a director who has responsibility for both the extramural and intramural programs. In other institutes a single intramural program is guided by a scientific director.
- The Director of NCI is appointed by the President and is advised by the National Cancer Advisory Board. Under this new structure, the NCI budget process bypasses the Director of NIH and the Secretary of DHHS, going directly to the President. This offers opportunities to make the case for NCI's budget directly to the administration.
- The NCI director has administrative latitude that other directors do not have, such as decisions concerning construction projects and the authority to appoint membersof the NCI Board of Scientific Counselors.

The total NIH budget in FY 1988 amounted to $6.7 billion, an increase of 160 percent over the $2.58 billion 1977 budget (NIH, 1988). In constant dollars (deflated by the NIH biomedical research and development price index), the increase from 1977 to 1987 amounted to 20 percent, an average annual growth rate of 1.8 percent. The intramural program represents approximately 11 percent ($700 million) of the NIH budget. The vast majority of the remaining money (about 85 percent), is distributed to the for-profit and non-profit research sectors through grants and contracts.

In many ways, however, it is more useful to consider the budgets of the 12 separate institutes. As Table I-1 shows, institutes vary in size, and in their rates of growth over the last decade. The NCI, with a 1987 budget of $1.4 billion (23 percent of the total NIH budget and 31 percent of the intramural program full-time equivalent employees), is by far the largest institute. After a period of explosive growth between 1970 and 1976, when its budget more that tripled, the NCI budget grew more slowly (about 6 percent per annum over the next decade).

The magnitude of each institute's intramural program that is carried out within NIH laboratories depends on a number of factors: the size of the particular institute's overall budget, the share of the budget allocated to the program, and the proportion of the intramural budget used to support activities in NIH laboratories versus contract activities (the latter in some institutes such as NCI can be large).

The agenda of the intramural program is under the direction of the institute director and the scientific director of each institute or division. The scientific directors* (who report to the director of their institute), can exercise a high degree of control over the institute's intramural program, with oversight provided by the institute's Board of Scientific Counselors, whose members are appointed from outside NIH. The Deputy Director for Intramural Research at NIH manages scientific policy problems and represents the intramural program of the institutes in aggregate in the overall policy councils of NIH.

In sum, NIH is a highly decentralized organization with numerous entities established by acts of Congress, each with its own appropriations that function with some considerable degree of independence.

*Most references to scientific directors are also intended to include NCI division directors, whose responsibilities encompass those of scientific directors in other institutes.

TABLE I-1 NIH OBLIGATIONS BY INSTITUTE 1977 - 1987 (DOLLARS IN MILLIONS)*

| | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | % Change 1977-87 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total NIH (Current) | $2,582 | 2,828 | 3,185 | 3,429 | 3,572 | 3,643 | 4,013 | 4,493 | 5,121 | 5,297 | 6,175 | 139% |
| Total NIH (Constant 1977) | 2,582 | 2,633 | 2,740 | 2,675 | 2,519 | 2,362 | 2,438 | 2,563 | 2,764 | 2,734 | 3,101 | 20 |
| % Intramural | 9.6 | 10.1 | 10.8 | 11.1 | 11.6 | 12.4 | 12.3 | 11.4 | 11.2 | 10.8 | 10.8 | |
| NCI | 815 | 872 | 937 | 998 | 989 | 986 | 987 | 1,081 | 1,178 | 1,210 | 1,403 | 72 |
| % Intramural | 12.6 | 13.4 | 13.9 | 14.4 | 15.7 | 17.2 | 18.2 | 17.2 | 16.5 | 17.3 | 17.5 | |
| NHLBI | 396 | 448 | 510 | 527 | 550 | 560 | 624 | 706 | 803 | 822 | 930 | 135 |
| % Intramural | 8.2 | 7.8 | 8.0 | 7.4 | 7.9 | 8.6 | 9.3 | 8.6 | 7.4 | 7.3 | 6.8 | |
| NIDR | 55 | 62 | 65 | 68 | 71 | 72 | 79 | 88 | 100 | 99 | 118 | 145 |
| % Intramural | 19.2 | 20.0 | 19.3 | 19.1 | 19.5 | 20.8 | 21.4 | 21.4 | 19.7 | 19.8 | 20.6 | |
| NIADDK | 219 | 260 | 303 | 340 | 369 | 368 | 413 | 464 | 539 | 436** | 511 | 133 |
| % Intramural | 14.1 | 13.1 | 12.4 | 11.9 | 12.5 | 12.9 | 12.6 | 11.9 | 11.0 | 11.5 | 11.3 | |
| NINCDS | 155 | 177 | 212 | 241 | 252 | 265 | 296 | 336 | 396 | 414 | 490 | 216 |
| % Intramural | 15.0 | 15.5 | 14.6 | 14.3 | 14.1 | 14.8 | 14.5 | 14.1 | 12.7 | 11.6 | 11.2 | |
| NIAID | 140 | 162 | 191 | 214 | 232 | 236 | 279 | 320 | 370 | 367 | 545 | 289 |
| % Intramural | 19.8 | 19.9 | 18.2 | 17.3 | 17.7 | 18.2 | 19.7 | 17.3 | 15.9 | 15.8 | 13.2 | |
| NIGMS | 205 | 230 | 277 | 312 | 333 | 340 | 370 | 416 | 481 | 493 | 571 | 178 |
| % Intramural | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.1 | |
| NICHHD | 145 | 166 | 197 | 208 | 220 | 226 | 254 | 275 | 313 | 308 | 367 | 153 |
| % Intramural | 10.7 | 11.3 | 10.5 | 10.3 | 11.5 | 11.5 | 12.4 | 12.5 | 12.2 | 11.3 | 11.2 | |
| NEI | 64 | 85 | 105 | 110 | 118 | 130 | 142 | 155 | 181 | 186 | 216 | 237 |
| % Intramural | 11.0 | 9.3 | 8.6 | 9.3 | 9.8 | 9.7 | 10.1 | 10.4 | 10.0 | 8.0 | 8.6 | |
| NIEHS | 51 | 64 | 77 | 84 | 93 | 106 | 164 | 180 | 194 | 189 | 209 | 310 |
| % Intramural | 26.4 | 27.5 | 28.2 | 29.8 | 30.1 | 27.4 | 29.7 | 31.1 | 27.6 | 27.6 | 27.7 | |
| NIA | 30 | 37 | 57 | 70 | 75 | 82 | 94 | 115 | 143 | 151 | 177 | 490 |
| % Intramural | 20.4 | 21.2 | 17.5 | 18.2 | 17.5 | 17.6 | 19.3 | 16.6 | 14.3 | 13.2 | 13.0 | |

NOTE: * Current dollars unless otherwise stated
** Funds transferred to establish Athritis Institute
SOURCE: NIH Division of Financial Management, 1988.

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# CHAPTER 1

# MISSION AND PURPOSES OF THE NIH INTRAMURAL PROGRAM

The mission of the National Institutes of Health (NIH) is described as "to improve the health of the nation by increasing the understanding of processes underlying human health, disability, and disease, advancing knowledge concerning the health effects of interaction between man and environment, and developing and improving methods of preventing, detecting, diagnosing, and treating disease" (NIH, 1986a). To accomplish this mission, several elements have been put in place, including programs to support basic and clinical biomedical research in universities, hospitals and research institutions; programs to support research training, and programs to communicate information to scientists, health care practitioners, and the public. The intramural program complements these functions, having a distinctive role within the overall NIH program. Its contributions stem from special characteristics including an environment that encourages research unlikely to provide quick pay-offs, and a capacity to provide a meaningful response to national health emergencies.

The Institute of Medicine (IOM) committee undertook a review of the mission of the intramural program for two reasons. First, the issue of privatization required consideration of whether the role of the intramural program could be achieved within a greatly altered institutional framework. Second, it was important to understand the related question of the appropriate contemporary role of the intramural program with regard to a national research environment that has changed radically in the course of the program's life. Changes in the overall environment for biomedical research have been especially rapid in recent decades. They have occurred not only in the nature of the science being pursued and the speed of scientific change, but also in the number of scientists and institutions engaged in the pursuit of new biomedical knowledge.

Consideration of the mission of the intramural program can lead to a discussion of the characteristics of the program. This is because, to many observers, it is the particular assembly of the characteristics of the program that create its distinctive place in biomedical research. The intramural program and the other major participants in biomedical research—universities, independent research institutes, and industry—have overlapping purposes, often conduct similar types of work in facilities that may resemble one another, and draw from the same employment pool. In the following sections we will describe the characteristics of the intramural program, not because they are individually unique, but because together they enable the program to fulfill its purpose.

## ROLE AS A GOVERNMENT LABORATORY

The government has as one of its functions to provide needed products and services that the private sector cannot or will not do. Although federal money flows to other participants in biomedical research, only the intramural program is both totally federally funded and staffed with employees who work directly for the government. This confers both advantages and obligations. The major advantage derives from financing that does not depend on discrete, time-limited grants or contracts awarded on a competitive basis. As a result, scientific projects can be long-term and resource managers can use more flexible criteria and individual judgment in resource allocation decisions.

As a government laboratory, the NIH intramural program is obliged to respond to congressional requests and national priorities that affect its scientific agenda. In practice, although Congress allows the program managers great discretion in establishing research priorities, there is a continuing, but beneficial tension in the appropriate balancing of congressional and scientific imperatives.

## THE ENVIRONMENT

The environment for science that has been created on the NIH campus enables the intramural program to pursue its goals. The importance of this setting has been recognized by many observers. The President's Biomedical Research Panel in 1976 described the program as:

> "An outstanding setting for a combination of clinical and basic research experience for promising young scientists and physicians by virtue of access to an innovative research hospital that facilitates the freest communication between laboratories and clinics and between creative investigation and practical application—it includes an extraordinary diversity of scientific competence that provides unique opportunities for interchange and collaboration; the opportunity for concentration of research without a requirement for teaching or health care service; and excellent, although diminishing resources" (Report of the President's Biomedical Research Panel, 1976).

Twelve years later this IOM committee heard similar sentiments both from witnesses at its public hearing and from scientists in the intramural program.

Undoubtedly, the environment plays an important role in attracting scientists to the intramural program—and is for some scientists the only setting with the freedom they need to perform creative research. The environment also plays a part in generating good science. The ability to initiate and conduct collaborative work quickly and effectively, the ease of communication across disciplines and institutes that is increasingly important as scientific disciplines more often use overlapping techniques and knowledge, all contribute to the quality work at intramural NIH. In addition, the existence of clinical research beds in close proximity to basic scientists encourages an increasingly important interaction between laboratory and clinical science. The existence on the campus of a critical mass of scientists allows an interchange of ideas that facilitates collaborative research.

The committee considered whether the loss of any substantial part or major characteristic of the intramural program would undermine the program's capacity to fulfill its missions. The committee decided, for example, that a clinical research center without basic research labs would undermine a synergy and scope that is difficult to duplicate elsewhere, and that there would be a diminution in the productivity of those who work in both areas. The committee also decided that making funding of projects fully competitive with extramural grants would decrease the ability of the program to undertake long-term research and respond to identified national needs. Reducing training opportunities would interfere, the committee believes, with efforts to encourage bright graduate students to commit themselves to a career at NIH.

## RESEARCH TRAINING

The intramural program has historically played an important role in training scientists in both basic and clinical research. This educational mission is accomplished through postgraduate programs for M.D. and Ph.D. scientists.

There are a variety of fellowship programs available for domestic and foreign researchers. Major domestic programs include Staff Fellowships, Senior Staff Fellowships, Epidemiology Staff Fellowships, Medical and Dental Staff Fellowships, Intramural Research Training Award Fellowships, and National Research Service Award Fellowships. Major programs for foreign trainees include: the Visiting Fellowships, Visiting Associates, and Visiting Scientists Programs.

Programs are available for those who show little or no postgraduate experience (Staff Fellows, Visiting Fellows, Intramural Research Training Awards [IRTAs], and Medical Staff Fellows), ranging to programs for those with 3–6 years of postdoctoral experience (Senior Staff Fellows, Visiting Associates, and Visiting Scientists).

Today, more than 2,150 U.S. and foreign fellows (1300 of whom are in a tenure-track type position) are receiving training and conducting research at the intramural laboratories of NIH. In addition to receiving valuable research training, this group represents over 50 percent of NIH's scientific workforce. It provides an important pool from which the intramural program recruits scientists for permanent, tenured positions.

Since the inception of the intramural research program, 25,000 M.D.s and Ph.D.s have received their training at NIH (NIH, 1988). A recent survey of the membership of the American Society for Clinical

Investigation (ASCI), showed that approximately one-third of its membership had, during the last three decades, receives a portion of their research training at NIH (Intitute of Medicine, unpublished data, 1988). The alumni of the various intramural fellowship programs are now among the leaders in academic medicine and biomedical research.

The committee supports the commitment of the intramural program to the education of research scientists. The multidisciplinary mass of scientists on the campus provides a distinctive environment for biomedical research training—an environment that is not fully duplicated in any other setting. It is important that the intramural program continue to develop new generations of researchers for biomedical science generally as well as for the future leadership of its own laboratories. The committee believes that the greatest strength of intramural training relative to other training locations is at the postdoctoral level. Although pre-doctoral education offered on the NIH campus (including the program of the Howard Hughes Medical Institute, which shows promise in attracting bright medical students to research) is valuable, to make the best use of the resources of the intramural program, continued concentration on postdoctoral training is advisable.

## BASIC AND CLINICAL RESEARCH

The 1953 opening of the Clinical Center on the NIH campus added a new dimension to the intramural program—a large capability for patient-related research in close proximity to basic research laboratories—and brought to the campus a new complement of physicians as well as other professionals and staff needed to run a research hospital. In 1986, the 540-bed Clinical Center, with the Ambulatory Care Research Facility, which opened in 1981, admitted nearly to 9,000 patients and was the site of more than 145,000 outpatient visits (NIH, 1987).

Numerous characteristics of the Clinical Center set it apart from other locations for clinical research. The most obvious are its almost complete devotion to research and its size, which by far exceeds any other clinical research center. The average size of the extramural units in the General Clinical Research Centers Program of the NIH is only 8 beds, ranging in size form 3 to 27 (NIH, 1986b). Another difference between the Clinical Center and extramural clinical research centers is that the patient is not billed for services in the Clinical Center and there are no financial pressures for early discharge. Rather, the length of hospital stay is determined by research needs. All support services, such as laboratory and radiology are structured to foster research as well as service objectives. Patient recruitment is national and international, enabling work on rare disorders for which it is difficult to assemble a patient base of sufficient size. The physical structure of the center is designed to facilitate cooperation and interchange between bench and bedside medicine, and access to the wide range of clinical and basic scientists on campus facilitates cross-disciplinary advice and collaboration.

By virtue of its size and organization, the clinical research component of the intramural program plays a vital role in the national research effort—the 540 beds at the Clinical Center represent approximately half the nation's dedicated clinical research bed complement. Moreover, the importance of bedside clinical research in the intramural program is increasing as financial pressures on teaching hospitals mount. These hospitals cannot afford to subsidize empty or under-funded clinical research beds. As cost containment pressure builds, these hospitals may have fewer opportunities to subsidize clinical research.

## THE APPLICATION AND COMMUNICATION OF RESEARCH

The justification for the government investment in biomedical research rests ultimately on the extent to which, in the long run, the health and quality of the life of the people of the United States are improved. This does not detract from the value of undirected basic research for which potential application is difficult to foresee. Rather, it argues that taken as a whole and over the long run, the nation must benefit from the investment. For this to occur, those who use the knowledge (most often medical practitioners) must be able to learn about it in a timely and reasonably easy manner. And, the organizations that develop and bring to market the results of research (most often the pharmaceutical and biotechnology industries) must have access to basic research findings. It is also important that the government research investment is used efficiently in terms of differentiating between what is most appropriate to a federally funded laboratory and what to industrial laboratories.

This committee believes that the mission of the intramural program was founded on its role in developing an understanding of basic disease mechanisms and facilitating the transfer of this knowledge to improve patient care. An important, informal mechanism for the dissemination of information has developed through a network of scientists in industry and elsewhere who trained or spent some part of their career in the intramural program and continue an informal connection. In general, the responsibility of the intramural program ends with technology transfer to academia, health care, and wherever else further applied research and development activities may be conducted.

To bolster the informal flow of ideas, the government acted to encourage the smooth and rapid transfer of technology through the provisions of the Stevenson-Wydler Technology Innovation Act of 1980 (P.L. 96-480) and the Federal Technology Transfer Act of 1986 (P.L. 99-502). The first of these laws requires federal laboratories to establish an office to identify discoveries with potential commercial application. The second allows government laboratories to enter into cooperative research agreements with other organizations, including businesses, and allows some royalty payments to researchers for use of their patents.

Communicating research findings to physicians in a rapid and responsible way is essential to ensure that benefits are derived from research in the intramural program. This is a responsibility that NIH shares with all institutions conducting biomedical research. The pharmaceutical industry, for example, has an extensive network designed to bring new products to the attention of the practicing physician. At NIH, as elsewhere, scientific status in part depends on publication in the most respected and widely used professional journals. In addition, NIH as a whole has become increasingly committed to the need to expand its communications with the public and the medical profession. In 1975, the Journal of the American Medical Association (JAMA) started publishing “Notes from the NIH,” which reported research applicable to clinical practice. A lecture series on “Medicine for the Laymen” was initiated. Public education efforts include pamphlets on a wide range of topics, and Consensus Development Conferences produce statements that interpret findings of clinical trials and evaluates treatment methods (Harden, 1986).

## LONG-TERM RESEARCH

Many characteristics of the NIH intramural program are conducive to productivity in research. Some of these were described to the committee as three freedoms—freedom to choose research topics without being restricted to the subject for which grant funding was obtained; freedom to devote all working hours to research; and freedom from the need to develop “grantsmanship” skills (Schaechter, 1988). These freedoms make the intramural program a favored locus for some of the nation’s most talented biomedical scientists and provide an environment more conducive than most to long-term research.

Long-term research conducted at the intramural program has paid off—in work on protein structure and function, neurotransmitters, and the “slow virus” work that was undertaken with the realization that it might take many years after primates were injected before evidence of disease could be detected.

Although today some other institutions relieve scientists of competitive pressures and are tolerant of work that may take years to become productive, the committee believes that the intramural program continues to have a major role in fostering these areas of research.

## THE INTRAMURAL PROGRAM IN RELATION TO THE EXTRAMURAL PROGRAM

The coexisitence of the intramural program and extramural grants administration under the same overall control and in the same location is felt by many to be an important characteristic of NIH. The benefits of this arrangement include, in some institutes, the ready availability of active scientists to provide advice to administrators of the extramural program, and the availability of a pool of scientists who, when ready to leave the bench, can bring their skills and experience to extramural grants and contracts administration. In the best of circumstances, the two programs can be thought of as complementary or collaborative efforts.

In practice, the administration of extramural grants is kept at arms length from the intramural program in order to avoid conflicts of interest due to intramural scientists working in areas of research that are the topic of specific grants. Furthermore, the institutes, with the exception of NCI, separate the intramural program from the extramural program administratively, typically having a scientific director responsible for the intramural program and a deputy director in charge of the extramural program.

The NCI differs from the other institutes in that each director of its four divisions is in charge of both extramural and intramural affairs. However, there are provisions to avoid conflict of interest between intramural and extramural in the review of grants. This closer association between the two programs is thought to allow more integrated scientific program planning and is enthusiastically endorsed by leaders at the NCI. There are differences of opinion about how the programs should relate to each other. The committee believes that an examination to determine the optimum structured relationship was beyond the scope of this study.

The committee heard differing views on the importance and benefits of having the intramural and extramural program together at NIH. And the members of the committee also differed in their perception of the importance of the relationship. However, committee members who were unconvinced by those who argue that the linkage is vital to the welfare of the programs felt that if a belief is so strongly held it may entail intangible benefits worth preserving. The committee therefore concluded that if an organizational model under consideration for the NIH requires the separation of the intramural program from the extramural program, very important benefits would have to occur to overcome the losses that might be associated with such a separation.

## CONCLUSION

Historical circumstances have created in the NIH intramural program a center that serves the nation well. The committee believes that institution-building is a precarious task in the sense that new institutional forms are far easier to contemplate than to build.

The committee concluded that for the next decades, all the major components of the current program are essential in providing an environment that can fulfill the purposes of the intramural program. This does not mean that all elements of the current program reflect an adequate level of vitality or accomplishment. Adaptation through selective change will always be required in order to sustain the vitality of the program. But the full implications of any change that would divorce constituent elements from the whole must be carefully scrutinized.

In reasserting some of the traditional purposes of the intramural program and confirming firming the importance of some of the characteristics of the program, the committee does not want to imply that the intramural program should be preserved as an unchanging entity. Rather, the managers of the program may need flexibility to adapt and preserve what is essential to accomplish the program's missions.

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# CHAPTER 2

# SCIENTIFIC EXCELLENCE OF NIH INTRAMURAL PROGRAM

The National Institutes of Health (NIH) intramural research program has made important contributions to basic research, clinical research, the training of young scientists, diffusion of knowledge, and national efforts toward specific health objectives. The record of the many medical scientists responsible for these accomplishments is universally admired. The committee, having determined for itself that the traditional missions of the intramural program are relevant now and will be into the foreseeable future, turned its attention to how well those missions are being accomplished. It examined evidence to determine whether the quality of the intramural program has diminished and whether any existing policies or practices are detrimental to future accomplishments.

Since the concepts of scientific excellence and creativity are difficult to define, let alone measure precisely, the committee looked at a variety of indicators of excellence, including:

- important discoveries by scientists in the NIH intramural research program,
- bibliometric studies,
- the number of NIH-trained or NIH-employed scientists receiving prestigious awards and memberships,
- replenishment of the scientific staff with young talent.

The intramural research program quality control mechanisms, while not direct indicators of excellence, can be used as process measures. Each of these indicators gives some measure of the quality of a scientific program—its influence on other scientists, peer judgments of scientific contributions, the quality of new talent, management processes that evaluate scientific personnel, and programs that guide the use of resources. Singly, these indicators lead to limited conclusions regarding excellence. If, however, they all point in the same direction, we can view conclusions with greater confidence.

## IMPORTANT DISCOVERIES BY SCIENTISTS IN THE NIH INTRAMURAL PROGRAM

To get a concrete sense of recent contributions of the intramural program to the biomedical knowledge base, the committee asked the directors of each institute to identify three outstanding examples of achievements of the intramural program in the last ten years. Appendix C lists these examples. Below is a selection that illustrates the range and importance of the intramural program.

## Advances in Clinical Practice and Applications

— Development of new vaccines against important bacterial infections of infants and children, including Hemophilus influenzae type B, pertussis, and typhoid.
— Development of a curative therapy for cystinosis, an inborn error of metabolism.
— Discovery of AZT as an effective agent against human immunodeficiency virus (HIV or AIDS virus).

## Achievements in Basic Science with Potential for Clinical Application in the Near Future

— Discovery of the human immunodeficiency virus (HIV) to be the cause of AIDS.
— Determination of the molecular defects in various types of abnormal lipoprotein metabolism.
— Discovery of an oncogene that led to the identification of the gene for cystic fibrosis and of another oncogene that codes for a growth factor.
— Discovery of the toxic effects of the enzyme, aldose reductase, in diabetes. Such effects probably underlie the complications of diabetes, such as blindness and nerve damage. Inhibitors of the toxic enzyme have been developed and are now in clinical trials.

## Achievements in Basic Science

— Characterization of different types of the protein phospholipase C, important in signal transduction mechanisms in cells, and demonstration that the sub-types of this protein are differentially present in specific cells and tissues.
— Development of recombinant DNA techniques, the first cloning of a mammalian gene.
— First demonstration of the molecular basis of antibody diversity.
— Discovery of interleukin-2, which is produced by a certain immune system cells called T lymphocytes; interleukin-2 also promotes the proliferation of T lynphocytes.

— Identification and cloning of the earliest genes to be expressed during embryo growth in vertebrates and determination of the products of those genes.
— Gene transfer and expression in intact animals using retroviral vectors.

### Special Programs and Achievements

— The Surveillance, Epidemiology, and End Results Program (SEER) is an intramural program which provides a statistical survey capability for tracking cancer incidence, morbidity, and mortality in the nation.
— Extensive program of evaluation of prosthetic heart valves and the mechanisms of their failure.

These examples of excellence illustrate why the committee believes that the intramural program has made, and continues to make, invaluable contributions to our knowledge of basic biologic processes and their dysfunction in disease. To probe more systematically and widely into the intramural contribution, the committee commissioned a bibliometric analysis of the scientific literature.

## BIBLIOMETRIC ANALYSIS OF PUBLICATIONS IN SCIENTIFIC JOURNALS

The term "bibliometrics" refers to the quantitative analysis of papers in research journals and of the citations received by these papers in subsequent journal articles. The extent to which published papers are cited by authors of subsequent papers is arguably the best single estimate of the quality of this published research output over extended time periods. Well designed experiments have yielded very high correlations (~.90) between peer judgments of quality and citation rates (Narin, 1983).

Since 1973, the National Institutes of Health Program Evaluation Branch has worked collaboratively with Computer Horizons, Inc. (CHI) to develop and apply a range of bibliometric tools to the analysis of NIH research and training programs. The NIH-CHI research collaboration and related efforts supported by the National Science Foundation (NSF) have produced extensive evidence of the validity, reliability, and utility of these tools for the assessment of research and training programs.

Caution in the application of bibliometrics is essential. When the number of publications is small, changes in either publication or citation rates may appear statistically significant, though they are of little practical significance. Therefore, it is desirable that data be aggregated into units of time and classification that are large enough to yield useful information. Large aggregates, however, mask such individual cases in which, for example, a paper reporting highly meritorious research might receive few citations simply because it is published in an unpopular journal or discipline, or because the work is so far ahead of its time that its significance is not recognized for years. Negative or critical citations, also important in the individual case, have virtually no effect in an analysis of large aggregates of papers. It is sometimes argued that the propensity for methodological advances to receive large numbers of citations is another limitation on the utility of citation data.

The fact that publication practices of scientists vary with their disciplines has significance for the analysis of bibliometric data. Citation practices also vary among disciplines, and it is essential that statistical measures be standardized within disciplines so that comparisons among them, and collective statistics across disciplines, may be valid and reliable. These cautions have been observed in the analyses that follow.

## Findings from Bibliometric Analysis*

Although the number of papers contributed to the biomedical sciences literature by the intramural research program increased during each four-year period between the mid-1970s and mid-1980s, the proportion of papers by intramural scientists declined slightly. This indicates that the intramural program continued to be increasingly productive, but the productivity (as crudely measured by publication counts) of the external world grew at a somewhat faster rate. But, when the focus of concern is on eminence as it is in the present analysis, a measure that permits comparison of performance at the top of the distribution of participants is desirable. For this kind of comparison the top citation decile is used. This measure is based on the frequency with which a specified subset of papers is found among the most highly cited 10 percent of all papers in the set. By this measure, the intramural program excels. Among papers published between 1981–1984, almost 25 percent of the top decile from clinical medical journals and almost 22 percent from those classified as biomedical research, were contributed by the intramural program. This performance has been consistent over the decade studied (Table 2-1). Comparing the average number of citations per paper received by intramural papers with the average number of citations per paper received by papers authored by academic investigators, the ratio has been approximately 2:1 (Table 2-2).

Another measure is the "average influence" of the journals in which papers are published. This is an indication of the relative quality of journals measured by the frequency with which these articles are cited by other journals. As with other quality measures, performance of the NIH intramural program is extraordinarily high. The average journal influence per paper for all U.S. papers during the period 1981–1984 in clinical medicine was 18.1; for intramural papers it was 30.2. The discrepancy is similar for the basic biomedical research journals. The journal influence average for all U.S. papers during the period 1981–1984 for the basic biomedical papers was 45.6; the intramural average was 62.0.

*This section is based on a paper (Gee, 1988) commissioned by the committee.

TABLE 2-1 Percent of Papers Authored by Intramural Scientists in the Most Highly Cited 10 Percent of All Papers

| | 1973-1976 | 1977-1980 | 1981-1984 |
|---|---|---|---|
| Clinical | 24.1 | 23.4 | 24.9 |
| Biomedical | 19.1 | 18.9 | 21.6 |

SOURCE: Gee (1988).

TABLE 2-2 Average Citations Per Paper: Ratio of Papers Authored by Intramural Scientists to Papers Authored by Academic Scientists

| | 1973-1976 | 1977-1980 | 1981-1984 |
|---|---|---|---|
| Clinical | 1.9 | 1.9 | 2.0 |
| Biomedical | 1.5 | 1.6 | 1.8 |

SOURCE: Gee (1988).

Examination of papers published in journals that are intended to serve the biomedical sciences broadly (e.g., Nature, Proceedings of the National Academy of Sciences, Proceedings of the Royal Society, Science, etc.) indicates that more than seven percent of intramural papers between 1981–1984 appeared in these journals (activity index 3.3). The average journal influence per paper for intramural papers in this category was 100, as against 80 for papers from universities and medical schools. More than 22 percent of the 1981–1984 papers were among the most highly cited 10 percent, even among the authors appearing in these highly influential journals.

Overall performance is, however, a crude measure that conceals a complex network of change over time. This is revealed when the data are subdivided by journal classification into the many separate clinical and basic biomedical disciplines in which NIH intramural scientists publish.

When intramural research activities are viewed from the perspective of individual disciplines, several patterns of change emerge. These changes for 27 clinical and basic biomedical sub-fields are detailed in Appendix D. Eleven sub-fields maintained extremely high levels of quality, with some even increasing in strength. Only six sub-fields lost strength in the top citation decile. On the basis of these measures, only one declined in both productivity and quality.

The committee was aware of the dangers of over-interpreting the results of the bibliometric analysis, but was satisfied that, overall, the intramural program demonstrated a high level of performance when compared with the general academic community. Analyses that compare the intramural program's mean citations per paper to selected elite research institutions, namely Rockefeller University and Scripps Clinic and Research Foundation, show that the intramural program ranks marginally below the latter and more substantially below the former. But as the author warned, "Comparisons of one institution with another should be undertaken with caution, owing to the diversity of research pursued by each and varying levels of citation among various fields" (The Scientist, 1988). Size of the institution also plays a role, and given the large size and scope of research, it is not surprising that the intramural program ranks below a smaller and more focused center such as Rockefeller University. Importantly, the NIH intramural programs' publication record has not deteriorated over time.

## PEER JUDGMENT OF SCIENTIFIC CONTRIBUTION

During the course of its deliberations, the committee inquired widely to gather comments from professional associations, foundations, and voluntary organizations on the issues being studied. The committee regularly heard of the accomplishments of the intramural program and the valuable contributions made by its scientific staff.

These accomplishments are reflected to some extent by the awards and honors intramural scientists have received, including four Nobel prizes since 1968 and more than a dozen Lasker Foundation awards. Of the approximately 60 members elected each year to the National Academy of Sciences (NAS) in the past decade, at least two to three per year have been NIH scientists (National Academy of Sciences, unpublished data, 1988). Over the past two decades, 28 percent of the NAS scientists in relevant specialties have either worked and/or trained at NIH. The American Society for Clinical Investigation (ASCI), which elects scientists aged late thirties to early forties, fills 5–15 percent of its places with NIH scientists. On average, each year since the 1950s, approximately one-sixth of those elected to ASCI have worked at NIH in some capacity. Roughly one-third, on average, of ASCI members elected annually since 1970 have received their training in the intramural program (Institute of Medicine, unpublished data, 1988). Four of the 9 American Federation for Clinical Research (AFCR) Young Investigator Awards were awarded to intramural physicians; 80 percent of the finalists for this award received their research training in the intramural program (L.Morrison, American Federation for Clinical Research, personal communication, 1988).

Looking at these accolades over time, there are no changes in the frequency with which NIH staff are honored. This information indicates that an elite core of scientists in the intramural program is among the nation's most highly regarded researchers.

## NEW YOUNG TALENT

Although the quality of senior-level scientists as indicated by peers remains high, NIH must be concerned about whether the stock of talent is being adequately replenished.

There are approximately 1,300 doctoral scientists completing their training now in various non-tenured positions at NIH (NIH, 1988). Unfortunately, there are no centralized data systems that allow the committee to compare the quality of the present cohort with earlier years.

The committee examined the records of some prestigious research training fellowship programs in an effort to detect trends in the numbers of young scientists taking such fellowships to NIH. It also analyzed data from the NSF's longitudinal survey of recipients of doctorates to get an indication of how the quality ratings of the graduate schools providing doctorates to NIH compared to those of other settings, and whether this measure of quality indicated any patterns over time at NIH. These crude indicators show little change. However, because relatively small numbers are involved in the samples, the committee was reluctant to place much weight on this evidence which runs counter to some powerful external factors. Chief among these is the growing number of employers, including industry, competing for the same pool of biomedical postdoctoral candidates. Also, the incentives of the doctor draft are not likely to be recreated to give NIH a large competitive edge as an employer of young physicians.

Lacking are both objective information on the quality of recent cohorts, and a means of measuring the extent to which the intramural program is having difficulty recruiting the best candidates. There is no information on the applicant pool, because prospective fellows tend to negotiate directly with intramural laboratories or with particular researchers. Candidates are often attractive to laboratories because of the particular training, experience, research accomplishments, or interest in an area of work rather than a more generic measure of quality such as grades, test scores, and graduate school reputation. The committee's interviews with NIH staff did not reveal the sense of a problem in recruiting the fellows when they wish. Senior researchers have been more concerned about full-time equivalent (FTE) limits and their ability to obtain the necessary position than their ability to fill those positions with the right person.

Because the application procedure for the medical staff fellowship (the major source of physician scientists) is centralized, some data about this group are available. There has been a precipitous drop in the number of applications submitted in the past two years, from 294 to 187. Unfortunately, NIH does not maintain records in a way that permits an assessment of the characteristics of the applicants accepted into the program; however, because NIH has continued to accept the same number of fellows from a shrinking number of applicants, one might be tempted to surmise that quality is declining. Anecdotal evidence is equivocal on this score. The president of ASCI has stated that salaries at this level are highly competitive. He believes that this, together with the opportunity to work at the Clinical Center, has enabled the intramural program to maintain its share of talent at the most junior levels. However, some medical educators have informally expressed concern about the lack of interest of some of their best students to pursue training at NIH.

One of the most critical factors in attracting postdoctoral candidates is the opportunity for them to work and learn under world-class senior investigators, as well as under rising young stars. The committee concluded that by focusing on improving the intramural program's capacity to continue to attract scientists in these categories, it will help ensure the quality of future postdoctoral cohorts.

## ADMINISTRATIVE MEASURES TO STRENGTHEN THE CURRENT PROGRAM

The mechanisms used by the intramural program to ensure quality are considered to be particularly important. Moreover, there has been longstanding concern among biomedical scientists that the review process for the intramural research program lacks the rigor of the competitive peer review process of the extramural program. The committee therefore reviewed the two major quality assurance mechanisms of the intramural program—the review of the intramural research laboratories conducted by the boards of scientific counselors, and the process through which scientists are selected for tenure in the NIH intramural program. A brief description of the current system and its recent history follows.

## Review of Intramural Laboratories

NIH policy states that "all research conducted intramurally must be reviewed regularly by highly qualified outside scientists." For this purpose, each institute appoints a board of scientific counselors to review the intramural work of each institute. The boards are composed of scientists with outstanding achievements and expertise in the fields under review. The institute's scientific director may invite additional experts to supplement the expertise of the board members for specific reviews.

Nominations for board membership are made by scientific directors and are approved by the Deputy Director of NIH and the individual institute director. Members are appointed by the Director of NIH. During these reviews, the board of scientific counselors considers the quality of research accomplished since the last review and its contribution to the institute's mission. Over a period of time, each laboratory and tenured principal investigator is examined, as are scientists being considered for tenured positions. The board offers advice to the scientific director regarding allocation of personnel positions, funding of specific research areas, and future directions for research.

Prior to the review, members of the board of scientific counselors receive written descriptions of the laboratories' research, staff qualifications, budget summaries, space allocations, and research support contracts. When the board meets, tenured scientists and junior staff report on present and planned research—board members have an opportunity to question the scientists and to visit laboratories.

Within four months of review, a report of the board's findings and recommendations is submitted for information to the scientific director, the director of the institute, the NIH Deputy Director for Intramural Research, and the Director of NIH. Following review by the boards of scientific directors of all the institutes, the report is sent to each institute's national advisory council for information and comment. The scientific director is required to report to the board of scientific counselors, at the earliest practical date, on actions taken on their recommendations (Eberhart, 1982; National Institutes of Health, 1986a).

Feedback to the board of scientific counselors was of particular concern to members of the 1984 Institute of Medicine's Panel to Study the Current Organizational Structure of the NIH (Institute of Medicine, 1984), who interviewed members of the Boards. Many board members expressed a desire to be better informed regarding the institutes' implementation of their recommendations, suggesting that their recommendations were not always given serious consideration.

In 1985, the Director of NIH recruited a group of external reviewers to examine the management of the Clinical Center. As part of the review, 8 experts from a broad spectrum of clinical disciplines evaluated 50 current or recently completed protocols selected by the director and deputy director of the Clinical Center. These protocols were chosen to represent "high quality" examples of research that made intensive use of the Clinical Center resources. The reviewers concluded:

> There was substantial variation in the quality of the protocols reviewed, from truly outstanding to quite poor, and there was also considerable variation of quality in and among the Institutes….
>
> The reviewers noted differences in the scientific merit review mechanisms among the Institutes and commented on the need for a more rigorous review mechanism in those Institutes where the protocols were weak (National Institutes of Health, 1985).

At about this time, Congress became concerned about the intramural review process in the context of deliberating on the 1985 Health Research Extension Act. The conference committee report notes the following:

> The conference agreement requires the Director of NIH to establish procedures for periodic technical and scientific peer review of all intramural research conducted at the National Institutes of Health. It is not the conferees' intent that the review procedures for intramural research be the same as those for extramural research….
>
> An entity conducting peer review of intramural research is to provide the institute's advisory council with a written description of the research, the results of the review and the recommendations of the reviewing entity. The conference agreement authorizes, but does not require, the advisory council to make recommendations to the institute director regarding intramural activities conducted by the institute (Health Research Extension Act, 1985).

As a result of congressional concern, the review process has been tightened. The recommendations of the boards of scientific counselors must be answered in writing by the scientific director of the institute at the next meeting of the board (National Institutes of Health, 1986b).

The committee commends NIH for its actions to strengthen the review procedures. It has, however, identified two specific points in the review system that lack mechanisms to ensure objectivity and accountability. First, while few question the stature of those who serve on boards of scientific counselors and as ad hoc consultants, the fact that they are nominated by the scientific director of the institute whose program will be under review compromises the external credibility of their report. Second, despite improved feedback to the board of scientific counselors on the implementation of their recommendations, the scientific director is at no time accountable to anyone outside the institute. Because this process is so often unfavorably compared with the rigorous extramural peer review—particularly by some who believe that intramural funds would be better spent for unfunded extramural projects—it is important that the system has real and visible safeguards.

A rigorous review process is necessary but not sufficient to sustain quality. The scientific director of each institute is key to the success of the research program, providing both intellectual and administrative leadership. Not only do the scientific directors control resources, but, less tangibly, they are responsible for the scientific esprit of the institute. Subsequent chapters include discussion of the problems of recruiting and retaining outstanding individuals for these jobs.

## Election to Tenured Positions at NIH

The long-term creativity and productivity of the intramural program depends to a great extent on the quality of the people who became tenured. Not only is their own productivity important, but they make up the pool from which the future leadership is drawn and play a role in attracting postdoctoral fellows to the intramural program. It is therefore important that there exists a rigorous procedure for selecting the 30 to 35 scientists who each year win tenure.

A scientist is usually eligible for tenure after 5 to 10 years as a postdoctoral fellow. The laboratory chief makes the decision about recommending the fellow for tenure. The successful candidate must pass review by the laboratory branch chiefs of his institute, the board of scientific counselors, the scientific directors of all the institutes, who vote by secret ballot, and finally the NIH Deputy Director for Intramural Research. This year-long process requires that the candidate be supported by at least six letters of reference as well as other evidence to support the case for tenure.

The intention of this process is to parallel its counterpart in universities. Whether the best scientists emerge from the process depends to a great extent on the caliber of fellows the laboratory chiefs propose as candidates for tenure.

Because of the NIH environment, where postdoctoral experiences often begin with assignment to work under a mentor, some believe that the time allowed is insufficient for a fellow to establish credentials as an independent investigator.

Lacking formal evaluations of the intramural tenure process, and not being in a position to make its own evaluation, the committee was unable to comment on whether the process is comparable to academic processes or whether it successfully selects the best candidates. In the course of its discussions, the committee heard some criticism of the NIH tenure process, including variability among institutes, and believes an evaluation is needed.

## CONCLUSION

This report has to do with sustaining excellence in the intramural program. As far as the committee was able to determine, using a variety of indirect measures, the intramural program has maintained its scientific stature. However, as is indicated later in this report, there are actions the NIH intramural program can take to improve its performance. There are also administrative problems that are beyond its control that could jeopardize quality in the future. The next chapter will describe these problems.

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# CHAPTER 3

# SIZING UP ADMINISTRATIVE PROBLEMS

Many of the problems of the National Institutes of Health (NIH) intramural program are described as administrative or bureaucratic and are related to NIH's position as a research institution located within a large federal department, the Department of Health and Human Services (DHHS). These particular problems can be organized around three major topics: (1) personnel, including compensation; (2) administrative barriers to a productive work environment; and (3) coping with a changing environment.

As stated in the introduction, the problems posed are neither new nor unique to NIH. Administrative problems seem to plague the entire federal government (National Academy of Public Administration, 1983; Levine and Kleeman, 1986; Volker, 1988). Mark Abramson, executive director of the Center for Excellence in Government, summed up the issue in testimony before a House committee holding hearings on creating a separate Federal Aviation Administration:

> The fundamental issue facing all of us concerned about government performance is simply whether government agencies can be made to "work" within the existing system. There are many who have concluded that our existing governmental systems which include departmental oversight and the maze of personnel, procurement, and other regulations, simply does not work, and that there are certain agencies which must now be taken "out of the system" and made independent entities.
>
> Representative Bruce Vento and Senator Bill Bradley recently introduced legislation to make the National Park Service an independent agency. Legislation has also been introduced to make the Social Security Administration and the Food and Drug Administration independent agencies. In all three cases, the reasons for "independence" are nearly identical to those cited for making FAA an independent agency—ineffective departmental oversight; a cumbersome, unpredictable budget process; and personnel and procurement regulations which impede the performance of those agencies (Abramson, 1988).

This ability of an entity to work effectively within the system is the key problem that has been raised with regard to the intramural research program at NIH. This chapter describes the committee's findings concerning personnel, procurement, space, travel, and administrative organization of the NIH intramural programs.

## PERSONNEL

The intramural research program accounts for approximately 10 percent of the total NIH budget, or $703 million out of $6.7 billion (NIH, 1988a). But it accounts for a majority of the NIH staff (approximately two-thirds of the total NIH full-time equivalent employment of 13,000 in fiscal year [FY] 1988). In addition, some 2,000 researchers who are not NIH employees (guest researchers, Fogarty Visiting Fellows, and scholarship recipients) also work in NIH research laboratories (NIH, 1988a; NIH, 1988b).

There are about 1,100 tenured doctoral-level researchers and 1,300 non-tenured doctoral-level researchers in the intramural research laboratories, assisted by some 2,500 support staff. In addition, approximately 3,400 employees of the intramural research program are in central support, including the Clinical Center, computer services, central supply, biomedical engineering, and central animal facilities.

The academic core of the research program is made up of the 1,100 tenured researchers. Individuals in this group have on average worked at NIH for nearly 15 years and are in their late 40s. The majority came to NIH as postdoctoral fellows and after a period of 4–7 years were granted tenure and have remained as independent research scientists (NIH, 1988a). These scientists are employed under three different personnel systems: the General Schedule, the Senior Executive Service/Senior Scientific Service (SES/SSS), and the U.S. Public Health Service Commissioned Corps (whose personnel are Commissioned Officers [CO]). Table 3-1a describes these three systems; Table 3-1b lists the current basic pay rates for them. The salary structure between the systems is linked at several points. The ceiling on base pay for General Schedule/General Managerial (GS/GM) employees is set at the pay of Level V of the executive schedule, $72,500. (This does not affect the payment of supplemental funds such as the Physician Comparability Allowance, [PCA]). The payment ceiling for the SES (including the SSS) is Level IV of the executive schedule, $77,500 (again not including PCA). The maximum compensation that can be paid under either system is that of Level I of the executive schedule, currently $99,500.

The salary structure of the U.S. Public Health Service (PHS) Commissioned Corps is more complicated because of the greater number of components that influence the pay of members of the uniformed services. Again however, base salary is limited to $77,500. Although there is no formal ceiling or cap, there are limits on the various components described in Table 3-1a, which set a de facto limit of approximately $105,000.

## COMPENSATION

The major administrative concern expressed by the senior NIH administration in papers prepared for the committee (NIH, 1988b), in congressional testimony (Wyngaarden, 1988), and as quoted in the popular press, is that the NIH salary structure is not competitive for researchers or for support staff, including nurses and allied health workers. An enduring perception of a general salary crisis notwithstanding,[1] the committee found this characterization to be an oversimplification. There are marry strengths that make NIH an extremely attractive working environment for the research scientist and that help offset salary discrepancies and administrative problems. These strengths include: the relative stability in mission, funding, management, and supporting infrastructures; the Clinical Center, which provides a national model for bridging the gap between basic and clinical research; the vast array of research services, facilities, equipment, and personnel; the ability to focus full-time on research activities; the ability to conduct research that may have distant payoffs; and the freedom from grant writing.

The organization of science at NIH does not lend itself to easy answers regarding personnel strategies in terms of how resources ought to be allocated to achieve the desired complement of personnel. For example, if junior scientists were attracted to the organization by the opportunity to work under distinguished senior mentors, it could be argued that resources would best be concentrated at the upper levels. Junior scientists would accept salaries below the market rate. Some laboratories at NIH follow this model, but since outstanding mentors can be found in other places, NIH must compete for junior scientists. An alternative model is less hierarchical and one in which mid-level scientists perform the most significant part of the work. In this case, pay of senior scientists is less important, and resources are concentrated at the mid-level. This model is also found throughout NIH. In an institution with this mixture of approaches, one monolithic recruitment and retention strategy does not satisfy the organization's needs. It is therefore important to examine the place of the intramural program in the market for each level of scientist.

The committee reviewed evidence concerning the adequacy of NIH compensation in light of the career paths for researchers and the current NIH salary structure. Because the intramural staff is so heterogeneous, the committee considered the adequacy of compensation for three groups of researchers: postdoctoral fellows (non-tenured scientists), mid-level (tenured), and senior scientists (tenured), and for support staff. The committee looked separately at compensation for M.D.s and Ph.D.s, because they are paid significantly different salaries by NIH and the private for-profit and non-profit sectors. In addition, the committee believed it necessary, in order to determine the seriousness of the compensation problem, to look at evidence of recruitment and retention problems and at comparative compensation figures.[2]

The committee believes evidence shows that NIH faces serious problems in recruiting and retaining senior scientists, particularly physicians, as well as various categories of support staff. The committee believes that evidence supports the concerns expressed by NIH that its salaries are not competitive for the most senior researchers, both M.D.s and Ph.D.s; that salaries are not competitive, in general, for M.D. researchers at the mid-level; and that salaries are not competitive for some support staff. Although there is overlap between Ph.D. and M.D. investigators in biomedical research, they are far from fully interchangeable. An organization whose mission includes both clinical and basic research and which operates a large research hospital cannot always substitute the less expensive Ph.D. for the physician who has alternative, more financially rewarding, career paths.

The committee finds that inflexibility in the current system of compensation causes significant problems. NIH pays higher salaries than necessary for some employees, and for other groups, lower. Its major problem appears to be that, because its salaries are tied to government-wide systems, it lacks the flexibility to respond to its special market demands.

## BEGINNING RESEARCHERS

### Employment Trends

The group of 1,300 non-tenured researchers represents the pool from which the majority of the tenured scientists are recruited.[3] In reviewing Tables 3-2 to 3-6b (which provide details on this group of researchers), signs are seen of continuing strength, as well as some indication of future problems.[4]

Between 1983 and 1988, the number of non-tenured researchers has fluctuated from year to year, while growing overall by 13 percent. During this period, the proportion represented by physicians held relatively stable at around 45 percent. However, the composition of the physician group changed. Foreign visiting physicians represented 21 percent of the group in 1983. By 1988 this figure had risen to 29 percent (Figure 3-1). The number of domestic physicians also increased, but more slowly. There was a shift toward entry into the Staff Fellow Program, and away from the Medical Staff Fellow Program.

Table 3-5 shows a troublesome trend in physician recruitment, as it presents data on the Medical Staff Fellowship Program and its precursor, the NIH Clinical Associate Program (Table 3-5 treats them as one). The table shows a significant decline in the number of applications distributed in 1987 and 1988, as well as a major reduction in the number completed during the period 1986–1988. These figures are consistent with the reduction in the total number of Medical Staff Fellows (Table 3-2).

FIGURE 3-1

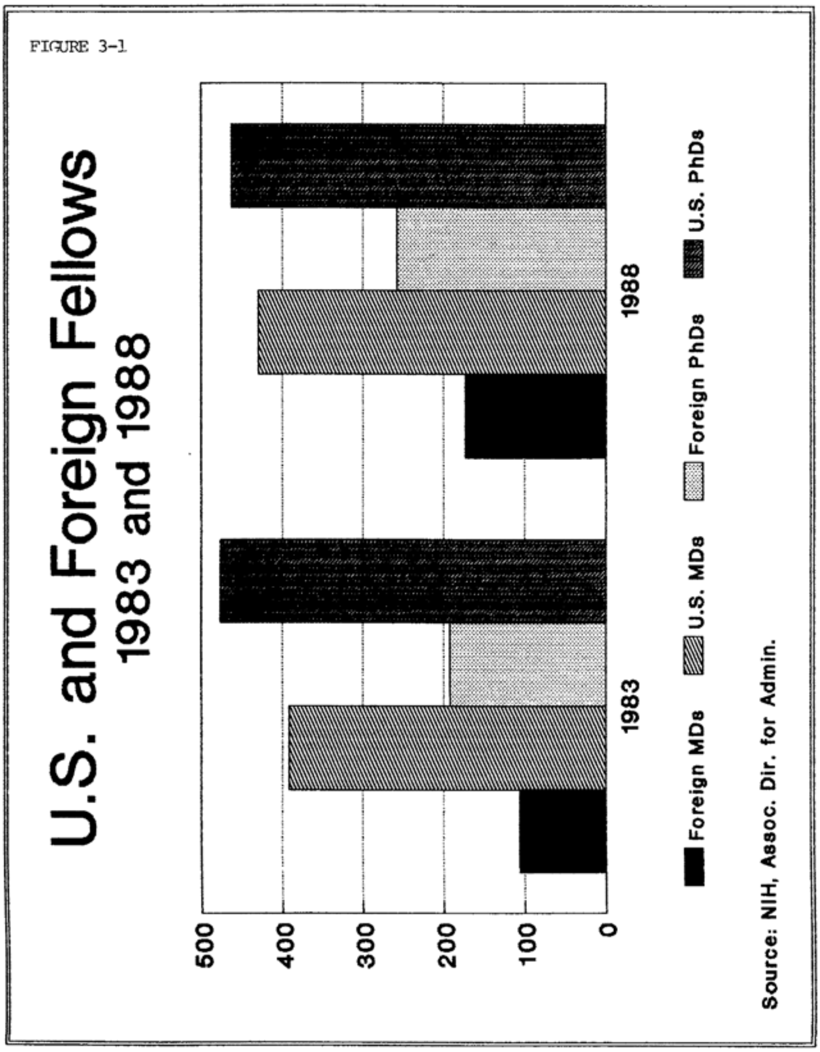


FIGURE 3-1
U.S. and Foreign Fellows
1983 and 1988
500
400
300
200
100
0
1983
1988
Foreign MDs
U.S. MDs
Foreign PhDs
U.S. PhDs
Source: NIH, Assoc. Dir. for Admin.

The reasons for these changes are not clear. NIH may be sharing in a national phenomenon. These changes may result from the increasing indebtedness of graduating medical students, and thus their unwillingness to pursue careers in the relatively low-paying field of research; a decline in the competitive position at NIH; or a random series of events. The committee believes, however, that future trends should be watched closely, because they may represent potential problems.

Table 3-4 indicates various combinations of appointments that may be used by non-tenured scientists in the intramural program. These scientists have up to 7 years from the time they become NIH employees to the time they receive tenure. Scientists originally appointed under the Intramural Research Training Awards (IRTA) program or the National Research Council (NRC) program, because they are not technically NIH employees, have an additional 3 years before the tenure decision has to be made. Tenure can, of course, be granted earlier, and in a number of cases, particularly for those with experience before coming to NIH, tenure is granted after 4 years.[5]

Tables 3-6a and 3-6b provide trend data on the rate of conversion of NIH fellows to permanent, tenured positions, and thus, on the ability of NIH to renew its ranks of career researchers from within.[6] These tables indicate that the average conversion rate for staff fellows, senior staff fellows, and epidemiology staff fellows has fallen from 8.3 percent during 1975–1979, to 4.9 percent during 1980–1981, to 4.2 percent in 1983–1987.

Interpreting this decline is complex. In part, it reflects the combination of how attrition rates and the FTE constraints of recent years result in few openings. Declining conversion rates may also indicate decreased ability to retain the best fellows or a sense that there are fewer outstanding scientists among the fellows.

## Compensation

Table 3-3 provides information on salary (stipend) levels for NIH non-tenured researchers. Salaries range from $20,000 to $43,452 for Ph.D.s, depending on the program and the experience of the individual, and from $24,000 to $50,744 for M.D.s. Visiting scientists are also included among those without tenure, but they are fully qualified, independent researchers from foreign countries and should be considered separately.

There are some limited, comparative data available on postdoctoral salaries in other institutions. A 1987 survey of biotechnology firms shows that salaries for Ph.D. postdoctoral scientists with 1–2 years of experience average $24,180, and that salaries average $29,053 for those with 2–5 years experience (Industrial Biotechnology Association, 1987). Limited information on nationally-awarded postdoctoral fellowships from organizations such as the American Cancer Society, Damon Runyon-Walter Winchell Cancer Fund, Helen Hay Whitney, and Leukemia Society of America, show stipend levels of $20,000 for the first year, with $1,000 increments occurring in the next 2 years. It is reported that some institutions supplement these awards with additional funds (telephone interviews, 1988). The 1987–1988 report on medical school faculty salaries indicated that Ph.D. instructors in basic science departments were paid an average of $28,000, and M.D. instructors in departments of internal medicine received an average salary of $51,000, while the average salary of M.D. instructors in all clinical departments was $60,200 (Smith, 1988). The instructor rank for medical schools is considered by NIH to be roughly equivalent to that of senior staff fellow (3–7 years postdoctoral research experience). [7]

Based on information available to the committee, it appears that NIH salaries/stipends for beginning researchers are roughly comparable to those paid by other organizations, such as medical schools, private research institutes, and biotechnology firms. One reason for the comparability of these salaries/stipends is that unlike salaries for permanent, tenured researchers, NIH has the authority to set stipend rates for trainees at appropriate levels because there is no government-wide salary schedule for postdoctoral researchers.

In spite of competitive salary schedules, such factors as lower conversion rates, lower numbers of applications for the Medical Staff Fellowship Program, and an increased in reliance on foreign M.D.s all point to potential problems in the future.

## MID-LEVEL RESEARCHERS

Mid-level researchers (GS/GM 13–15 and CO 4–6), both physicians and Ph.D.s, make up the second major group of scientists in the intramural program. These are tenured, independent investigators, roughly equivalent to assistant, associate, and full professors in an academic setting. Table 3-7 provides information on NIH grades and positions, as well as the university equivalents. It is this group, along with the senior researchers, that NIH has expressed the most concern about being able to recruit and retain.

### Employment Trends

The mid-level research staff increased by 6 percent between 1983 and 1988 to 991 (Table 3-8). The major increase occurred in 1984 and 1985. The percentage of physician researchers has declined slightly, from 41 percent in 1983 to a current level of 38 percent. Again, the major change occurred between 1984 and 1985 and represents an increase in the number of Ph.D. investigators rather than any marked reduction in the number of M.D.s.

Grade distribution (Table 3-8) among mid-level researchers has remained fairly constant, with the exception of M.D. researchers in the Commissioned Corps where the percentage of 00–6 officers (equivalent to an academic rank of professor), has increased from 52 to 70 percent of the CO-04, CO-05, and CO-06s. The percentage of mid-level researchers, as a percentage of the total tenured researchers, remains above 90 percent, but declined slightly as a percentage of the total number of researchers (tenured and non-tenured), being 43 percent in 1983, and after reaching a peak of 44 percent in 1985 and 1986, declining to its current level of 41 percent.

Overall, there have been modest gains in the number of tenured, mid-level researchers during the period 1983 to 1987. These gains have occurred simultaneously with a decline in full-time equivalent (FTE) employment of all types of personnel in the intramural program from 8,729 in FY 1983 to 8,332 in FY 1987 (NIH, 1988a). The increase in the number of researchers (both in actual numbers and as a percentage of intramural employment) is due to such factors as: (1) a deliberate decision by NIH to increase the number of scientists as the budget increased, (2) vacancies in the number of support positions caused by difficulties in recruiting clinical and allied health workers because of non-competitive salaries, (3) management reviews, which convinced NIH that better organization and management could lead to a reduction of the number of positions in the Clinical Center and in research support services (ranging from procurement to central supply), and (4) the decision to contract out certain Clinical Center functions including housekeeping, food services, and escort services. Also during this period, the Clinical Center decided to contract out the departments of anesthesiology and diagnostic radiology. While this decision freed up some 35 FTEs, it was not done for this reason, but because NIH could not fill the positions at the federal salary levels. The increase in the ratio of non-tenured to tenured scientists may also represent a decision to use the former to replace difficult-to-recruit technicians—given both non-competitive salaries and strict FTE ceilings.

## Attrition

An important indicator of inadequate compensation is attrition. Table 3-10 provides information on attrition of researchers at NIH, and Figure 3-2 graphically illustrates this information over time. Overall attrition for mid-level investigators averaged 6.3 percent from FY 1983 through FY 1987. The rate was higher for physicians (8.8 percent) than for Ph.D.s (4.5 percent).

With few exceptions, such as in 1983 when more than half the CO-4 and CO-5 level physicians left, attrition rates have fluctuated between 4–9 percent both for physicians and non-physicians. There does not appear to be a trend toward increased attrition and the attrition rate compares favorably with some comparable organizations.

The Nuclear Regulatory Commission between 1985 and 1987 had attrition rates among its scientists of 10 percent, 8.9 percent, and 10.9 percent respectively (personal communication with staff of Nuclear Regulatory Commission, 1988). The National Institute of Standards and Technology (NIST) in the Department of Commerce reports an attrition rate of

FIGURE 3-2

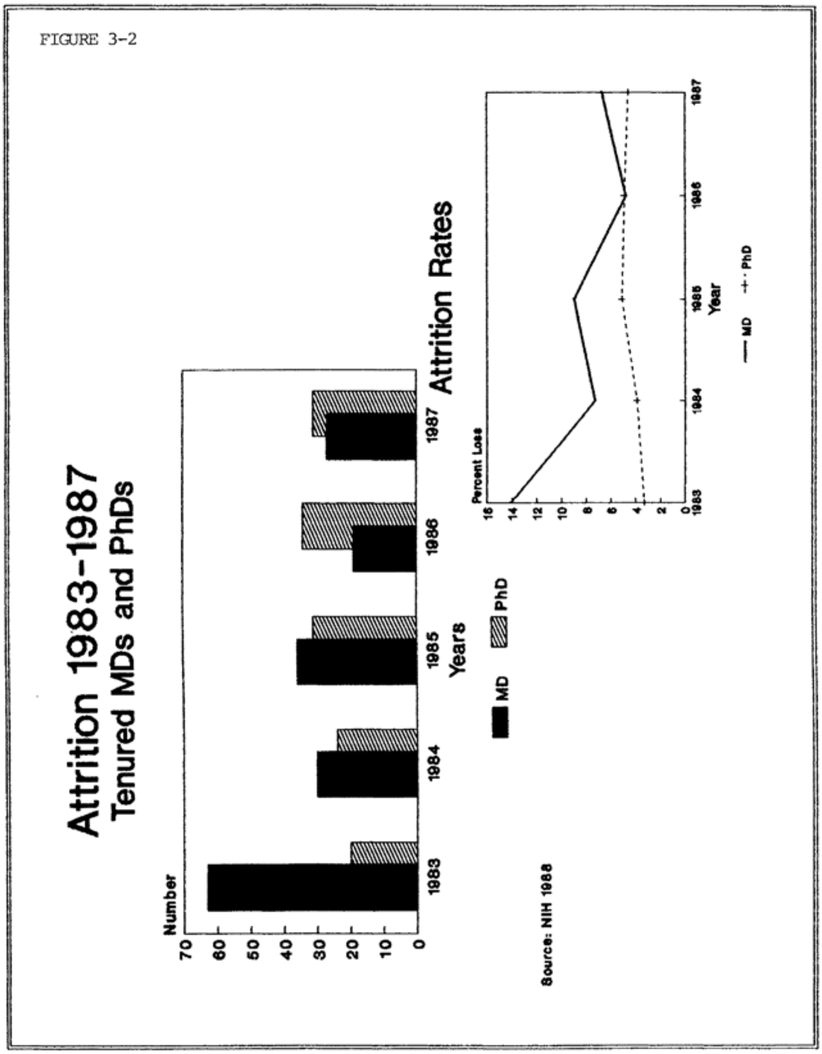


FIGURE 3-2
Attrition 1983-1987
Tenured MDs and PhDs
Number
Years
MD
PhD
Source: NIH 1988
Attrition Rates
Percent Loss
Year

approximately 5 percent for its scientists and engineers, and is concerned that such a rate may be too low (personal communication with staff of NIST, 1988). A 1984 study by the U.S. General Accounting Office (GAO) on attrition of scientists and engineers in the SES found an attrition rate of approximately 33 percent in 7 agencies over a 5-year period (GAO, 1985). A 1987 survey of biotechnology firms shows an average turnover rate of approximately 10 percent among scientists (Industrial Biotechnology Association, 1987). Data from the Association of American Medical Colleges (AAMC) show annual attrition rates of between 4 and 6 percent for Ph.D.s, and between 7.5 and 5 percent for M.D.s in U.S. medical schools between 1980 and 1985. The lowest rates for both groups occurred in 1985 (Jolly, 1986).

The committee does not believe that the attrition rate among mid-level researchers is too high. However, this does not mean that NIH may not be losing some of its best researchers. What is not known is the percentage of outstanding researchers who are leaving, or if this percentage is increasing. Indeed, the committee considered whether the 6.3 percent attrition rate, coupled with very slow growth in the NIH workforce, might not indicate problems of organizational stagnation. Like many academic institutions with a significant proportion of tenured faculty, NIH may confront difficulties in providing career growth for valued younger personnel. At the same time, such institutions will find themselves with an aging workforce.[8]

## Recruitment to Mid-level Positions

Between 1983 and 1987 the intramural program lost some 300 mid-level researchers. These 300 were more than replaced through conversion from postdoctoral fellowships (47 percent), hiring from outside government (21 percent) (Table 3-11), and promotion, reassignment, and transfers from other parts of the government.[9] Most of those recruited from outside the government were at the GS/GM 14 and 15 levels, equivalent to university associate professor or professor rank (Table 3-12). Thus, contrary to some perceptions, NIH has a mix of promotion and hiring to mid-level positions.

## Compensation

It is difficult to determine how the salaries of NIH mid-level researchers compare with their counterparts in other settings, because there are few, if any, direct counterparts to NIH in the private sector. The most logical comparisons are with medical schools, private research laboratories, and private biotechnology firms. However, none of these is identical to NIH in mission, compensation, structure, or work environment. It is also difficult to know if the appropriate salary comparison is at the mean or at some other level and to know what level of comparability is necessary in order to ensure the recruitment and retention of high quality researchers.

With the exception of medical schools, compensation information is relatively limited, and longitudinal data are lacking. Comparisons are also difficult because other organizations are independent and average figures hide great variations between organizations, frequently even within organizations. It is also difficult to decide which jobs are equivalent when surveys are made across positions and organizations.

Table 3-13 compares NIH salaries with a number of groups and organizations which compete with NIH for researchers.[10] The picture is mixed and NIH is very competitive for researchers at some levels, while not competitive at others. Generally, NIH is more competitive for Ph.D.s than M.D.s, and more competitive at the lower grades or ranks. It is competitive with Uniformed Services University of the Health Sciences (USUHS) and overall AAMC averages for Ph.D.s through the GS-15/professor level, and relatively competitive with USUHS for M.D.s through the GM-15/professor level. The picture is more complex with regard to AAMC data and exemplifies the problems of making comparisons across organizations. As the table shows, the picture changes, depending on which comparison groups are used.[11] However, only at the lower end of the scale (GS/13—assistant professor and, in the case of pediatricians with a base salary, GS/14—associate professor), are NIH salaries for physicians competitive. The picture with regard to private research institutes and biotechnology firms is even less clear, because there are less comprehensive data, and since many private research institutes have only a few researchers, each one is treated individually.

Several facts are apparent with regard to salaries at independent research institutes and academic institutions. They tend to have much broader pay ranges than NIH and, thus, much more flexibility in paying market rates and in meeting competition for researchers whom they particularly want to retain or recruit. This flexibility is enhanced by having the salary ranges overlap, which permits them to pay an associate professor (GS-14) more than a full professor (GS-15). Additional flexibility is provided by not having a cap or ceiling on the full professor (or equivalent) salary at many institutions. Some, though not all, of these institutions allow their researchers to do outside consulting (usually one day per week), and some share patent royalties with the researcher. With regard to biotechnology firms, not only is it difficult to judge comparable jobs, but salary information is treated as highly confidential.

Data from a 1987 survey of more than 130 biotechnology firms also provides useful salary information on 4 categories of Ph.D. researchers:

- Scientist I, 0–2 years after completion postdoctoral experience, receive an average salary of $37,000.
- Scientist II, with 2–5 years postdoctoral experience receive an average of $43,000.

- ○ Scientist III, with 5–10 years postdoctoral experience receive an average salary of $50,000.
- ○ Scientist IV, with more than 10 years postdoctoral experience receive an average salary of $58,000.

In addition, approximately 20 percent of the scientists in the first category were eligible for incentive packages totaling 4 percent of base salary. This increased to 55 percent of the scientists in the fourth category, where incentive packages averaged 7.3 percent of base salary.

The same survey showed that annual salaries for senior clinical researchers (M.D.s), positions roughly comparable to the GS-15 level at NIH, averaged $96,000 (Industrial Biotechnology Association, 1987). Based on this relatively limited data, it would appear that NIH salaries for mid-level Ph.D. researchers are comparable to those paid by the biotechnology industry and that NIH salaries for M.D.s trail by approximately 10 to 20 percent.

The National Science Foundation (NSF) survey of doctorate recipients provides additional information on the competitiveness of NIH salaries for Ph.D. researchers. The survey contains a representative sample of more than 50,000 doctorate holders in the United States. The sampling rate for those disciplines employed by NIH is approximately 1 in 10. It is a longitudinal survey with the sample re-interviewed every two years.

Table 3-14 shows the 1981 and 1987 salaries of researchers employed at NIH in 1981; those who remained at NIH received an average 1987 salary of $54,500, while those who left averaged $60,564. Additional detail from the survey, which shows salaries of individuals in the upper quartile, indicates the impact of the federal salary cap, with NIH salaries clustering between $66,000 and $75,000, while salaries for those who left NIH range from $70,000 to $100,000 (Michael Finn, Office of Scientific and Engineering Personnel, National Research Council, communication to committee, 1988).

Table 3-14 does not document large disparities; it does indicate, however, that NIH salaries for Ph.D.s (at least for those with multiple opportunities) have not kept pace with the private for-profit and non-profit sectors. Also, because of salary ceilings and resulting pay compression, NIH is the least competitive for the most senior scientists. The numbers in the sample are very small, but the findings are consistent with other information.

It should be noted that Table 3-14 includes both mid-level and senior Ph.D. researchers. Based on the distribution of salaries, it appears that disparities are greater for senior researchers than the larger group of mid-level researchers.

Another important issue is how NIH salaries compare with those of other organizations over time. For this comparison, the best source is AAMC data on medical school salaries. Tables 3-15 and 3-16 show mean NIH compensation as a percent of mean AAMC compensation for Ph.D.s in basic science departments and M.D.s in clinical science departments. These tables show that for mid-level researchers, both M.D.s and Ph.D.s, NIH compensation has fallen compared to that of researchers in medical schools. For M.D.s, the decline has been between 9 and 10 percent, depending on the grade; for other doctorates, it has been between 11 and 14 percent. There does not appear to be any particular pattern with regard to grade within the ranks of mid-level researchers, i.e., from lower to higher or vice versa.

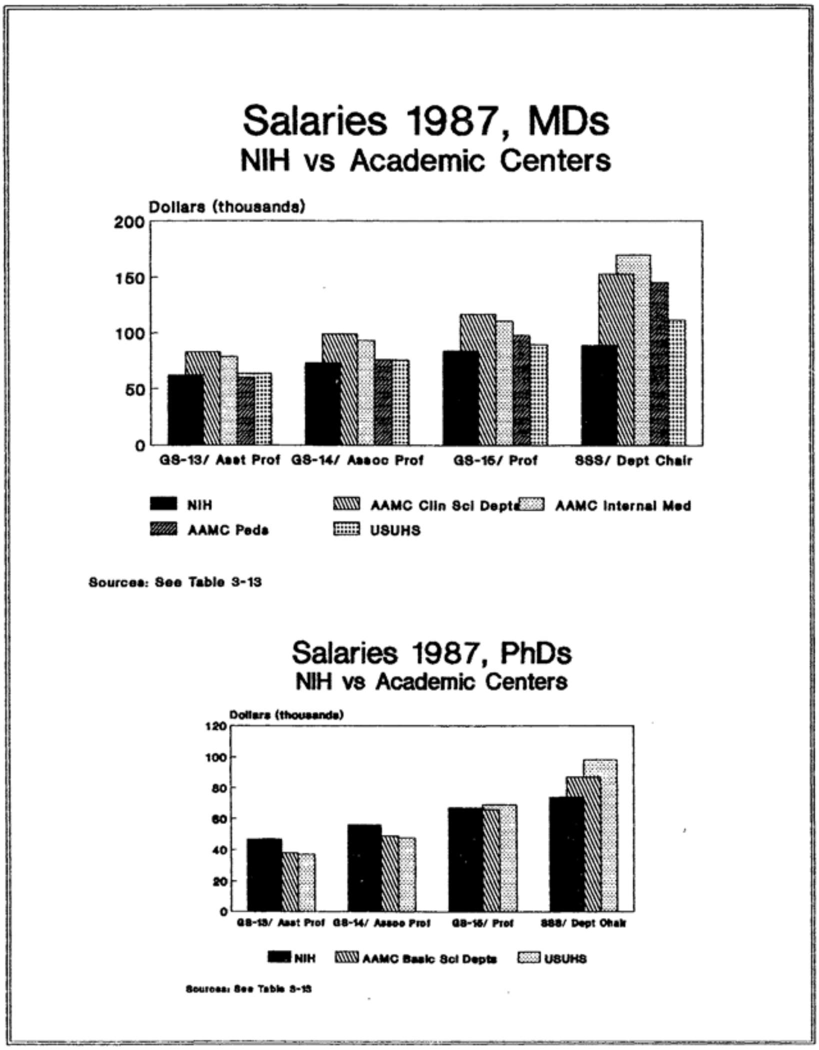
In sum, the data on recruitment and retention (attrition rates, conversion rates, number of individuals recruited from outside government, etc.), of mid-level researchers do not show evidence of major problems for either M.D.s or Ph.D.s. With regard to salary comparability, the information is somewhat more mixed (Figure 3-3). Comparing average salaries, NIH would appear to be competitive for a researcher holding a Ph.D. degree. There is limited evidence that Ph.D. researchers who leave NIH receive higher salaries than those who remain. Data on salaries paid by academic institutions, independent research institutes, and biotechnology firms indicate that broader overlapping pay bands provide these organizations much greater flexibility in compensating their mid-level researchers. The committee finds that this lack of flexibility, rather than any overall lack of salary competitiveness, provides NIH with its greatest difficulty in retaining mid-level Ph.D. researchers. Such flexibility might include, in special cases, the ability to pay above the pay band (or the provision of broader or overlapping pay bands), the ability to pay above the cap (currently $72,500, $77,500, or $99,500, depending on grade level and degrees), the authorization of recruitment and retention bonuses, or accelerated hiring or promotion procedures.

With regard to physician researchers, there is a pay disparity above the lowest ranks of mid-level researchers. A slightly lower percentage of physicians among the tenured researchers and a rapid increase in their age suggest that the salary disparities may be causing recruitment and retention problems. Again, however, the committee does not believe the evidence justifies significant overall salary increases. As with Ph.D. researchers, the committee believes that the major problem relates to the lack of flexibility in the current salary system, which prevents NIH's recruitment or retention of individuals particularly important to its programs.

## SENIOR RESEARCHERS

Much of the concern, especially in the lay press, over the loss of scientists at NIH has focused on senior researchers—the scientific superstars. Senior scientists (SSS and CO-7, and some GM. 15 and CO-6),

FIGURE 3-3


Salaries 1987, MDs
NIH vs Academic Centers
Dollars (thousands)
200
150
100
50
0
GS-13/ Asst Prof
GS-14/ Assoc Prof
GS-15/ Prof
SSS/ Dept Chair
NIH
AAMC Clin Sci Depts
AAMC Internal Med
AAMC Peds
USUHS
Sources: See Table 3-13
Salaries 1987, PhDs
NIH vs Academic Centers
Dollars (thousands)
120
100
80
60
40
20
0
GS-13/ Asst Prof
GS-14/ Assoc Prof
GS-15/ Prof
SSS/ Dept Chair
NIH
AAMC Basic Sci Depts
USUHS
Sources: See Table 3-13

constitute about 8 percent of the permanent scientific staff of the intramural program. The group, which includes laboratory chiefs and the scientific directors of institutes, is equivalent to professor-level and above in a university. Between 1983 and 1988, the total number of senior researchers has fallen approximately 10 percent, from 95 to 86, and physicians as a percent of total senior staff have fluctuated between 30 and 33 percent.

## Attrition

Attrition among all senior researchers averaged 3.4 percent a year between FYs 83 and 87; percentages for M.D.s and Ph.D.s were 3.8 and 3.2, respectively. As expected, given the small numbers involved, there was considerable variation by year, but no apparent trend.

Although attrition rates are quite low, replacements represent a problem. Fifteen senior scientists left NIH during this period and six had been replaced as of May, 1988—all by promotion from within. In fact, NIH has not recruited anyone to the SSS from outside the organization since its creation. This contrasts sharply with the fact that 105 mid-level scientists were brought in from outside government during the 5-year period 1983–1987.[12]

The average age and length of experience increased for these senior researchers. Between September 30, 1983 and May, 1988 the average age of Ph.D.s in the SSS increased from 56.9 years to 59 years, and the average years at NIH from 21.6 to 24.7. The increase in average age for M.D.s has been less dramatic, from 57.4 to 58.4, however, the average length of experience at NIH has increased from 15.8 years to 19.4 years.

Table 3-10 shows that the Ph.D.s are leaving at normal retirement age (mid-to-late 60s), while M.D.s, with some exceptions, are leaving in their early-to-mid 50s.

## Compensation

Tables 3-13 to 3-16, Figure 3-3, and the survey of biotechnology firms, provide comparative information on the salaries of senior research scientists. When compared with those of the USUHS, medical school faculties, or senior researchers at private research institutes, NIH salaries are significantly lower. This is true both for M.D.s and Ph.D.s, although the disparity is greatest for researchers with M.D. degrees.

The problems of comparing salaries across different organizations is highlighted in trying to find proper groups against which to compare senior NIH researchers. As has been noted, NIH has for many years compared members of the SSS with medical school department chairmen. While it seems reasonable to do this with regard to some members of the SSS—division directors, scientific directors, some laboratory chiefs, it is not clear that the comparison is appropriate for all members of the SSS. While all of the members of the SSS have managerial and policy duties, their levels of responsibility vary significantly.

To have the widest range of comparisons, the committee compared members of the SSS with department chairmen (Ph.D.s with Ph.D. chairmen of basic science departments and M.D.s with M.D. chairmen of clinical science departments); it also compared M.D. members of the SSS with chairmen of departments of internal medicine and pediatrics (thus eliminating high paying medical school departments, such as anesthesiology and radiology, which lack NIH counterparts); and it compared M.D. members of the SSS with full professors at the 80th percentile. Even with these more limiting comparisons, the gap between NIH salaries and those in medical schools is still significant at the level of SSS.

Tables 3-15 and 3-16, comparing NIH salaries with basic science and clinical science chairmen, show that the gap has widened over time. For example, in 1983, senior Ph.D.s at NIH received salaries comparable to those of the chairmen of basic science departments. By 1988, they were paid an average of 83 percent of what department chairmen received. The disparity for M.D.s increased an additional 10 percent during the same 5-year period.

One reason for this lack of competitiveness is the federal salary cap. Table 3-14 shows changes in average annual salary for Ph.D.s working at NIH in 1981 and in 1987, as well as the changes in salary by type of employer for those who left NIH. Senior scientists employed by universities/medical schools had average salaries above the maximum allowed by the federal salary cap. That table, which includes both mid-level and senior-level Ph.D.s, indicates that researchers employed at NIH in 1981, but who left there prior to 1987, earned higher average salaries than their counterparts who remained. Private research institutes generally have no fixed upper limit and frequently offer salaries over $100,000.

While comparative data are quite limited at this level, it would appear that total compensation offered by biotechnology firms also exceeds the compensation that NIH can offer. Additional insights are shown by examples of key individuals NIH lost between 1983 and 1988.[13]

The reduction in the number of senior researchers, the increasing age of those remaining, the failure to successfully recruit from outside, and the evidence of generally noncompetitive salaries justifies NIH concerns about their future ability to recruit and retain senior researchers and research administrators. This is particularly serious since many of the current researchers are approaching retirement age. Again, as with the mid-level researchers, the problem is lack of flexibility within the current personnel system. This problem is exemplified by the federal pay cap ($77.5 thousand in base salary, $99.5 thousand total salary).

Personnel losses are not inherently bad. In fact, a function of NIH is to develop researchers, who will leave to create programs of excellence elsewhere. When senior intramural researchers leave, new researchers have a chance to develop and became the next generation of superstars. However, if losses became abnormally high, or if quality replacements cannot be developed, an organization faces decline. The question is one of balance, of enough turnover to allow new blood without diluting quality. The committee believes that NIH's primary concern should broaden from the loss of senior researchers to its capacity to revitalize at all ranks.

## SUPPORT STAFF

Salary problems also affect research support staff, particularly secretaries, nurses, and allied health workers. Interviews with NIH staff produced repeated discussions of problems in recruiting and retaining secretaries and technical support personnel.[14] One institute scientific director said "nothing can cause a good laboratory to break down faster than the loss of a top-notch lab secretary—the glue that holds the place together" (NIH staff interviews, 1988). Others complained of difficulty and delay in filling vacant positions and of recruiting qualified applicants. For example, concerns about a number of occupations are expressed in the recent Report of the NIH Directors Task Force on the Shortage of Nurses in the Clinical Center. With regard to allied health workers the report states:

> The present salary and benefits package for Allied Health Personnel is far below the compensation offered by neighboring hospitals. Area hospitals are paying salaries that range from 11 percent to 28 percent higher than that being paid by the Clinical Center. This has resulted in extraordinary vacancy and turnover rates…. After examining this data, the committee recommends that a legislative amendment be vigorously pursued that extends the Title 38 pay and benefit options to Allied Health Care workers (NIH, 1988c).

Table 3-17 provides salary comparisons between NIH and eight major Washington area hospitals for selected allied health professions. It is reported that the difficulties with medical technologists and phlebotomists are of recent origin. This again points up the problems NIH faces because of its rigid salary structure and the extended time involved in making changes.

The current situation involving nurses is more positive than it has been in recent years. Significant shortages, beginning in 1983, led to the passage of legislation that allows NIH to employ nurses at the Clinical Center under the authority of the Veterans Administration Title 38, which authorizes the setting of competitive pay rates. The following excerpts from the Director's Task Force Report summarizes the situation over the last several years:

> In 1983, the Clinical Center experienced the first significant impact of what was to become a major crisis in nursing. Significant problems were encountered in staffing the medical oncology service of the Cancer Institute, subsequently necessitating the closing of 20 of the available 40 beds for that activity. Problems in recruitment and retention of oncology nurses were felt to underlie this shortage, and were attributed by the nursing service to the stresses of oncology nursing, as well as the noncompetitive salaries offered by NIH. The nursing shortage led to a number of consequences which adversely affected clinical research: a halt to new patients accession to protocols, "boarding" in-patients on non-cancer wards, and a slowing of implementation of new protocols for cancer and AIDS. Similar shortages subsequently affected the staffing of a number of other services at NIH, and forced curtailment of clinical research utilizing the surgical intensive care unit and the medical intensive care unit, as well as patient admissions for cardiac surgery, neurosurgery, mental health, and AIDS…. (NIH, 1988c).

The current pay system for nurses, which allows the U.S. Assistant Secretary for Health to set competitive salaries, is an example of the type of flexibility that the committee believes NIH needs to continue to function effectively.

## SUMMARY OF COMPENSATION FINDINGS

Based on its analysis of compensation of individuals in the intramural research program at NIH, the committee finds that:

- Government-wide salary ranges are not competitive for either M.D. or Ph.D. researchers at the most senior levels (SSS, C0-7) or for physician researchers above the beginning middle levels (GS-13, CO-4). Salaries are, however, competitive for junior scientists, and Ph.Ds at the mid-level.

- ○ Over the last -157- years, NIH salaries have not kept pace with salaries in the nation's medical schools.
- ○ Significant pay problems exist, or have recently existed, with regard to secretaries, nurses, allied health workers, and other technical support personnel.
- ○ The government personnel system does not have the flexibility to adjust salaries to meet specific needs in a timely manner without increasing all salaries.
- ○ There have been losses of significant researchers and major difficulties in recruiting replacements at the senior levels (SSS, C0–7).

## THE PERSONNEL SYSTEM

The personnel system includes all laws, rules, regulations, and procedures involving recruitment, maintenance, payment, promotion, and retirement of employees. The system deals with rates of pay, fringe benefits, position classification, employee evaluation, awards, and a myriad of other details. The previous section focused exclusively on that part of the personnel system dealing with compensation; this section deals with all other aspects of the system.

### Impediments Created by Externally Controlled Personnel Systems

The employees of NIH are largely governed by three personnel systems: the GS, the SES/SSS, and the U.S. Public Health Service Commissioned Corps (Table 3-1a). These three systems are all controlled by organizations beyond NIH (Commissioned Corps by the Public Health Service, and the GS and SES/SSS by the Office of Personnel Management [OPM] and DHHS). They are general systems designed to meet the needs of a wide variety of organizations and, therefore, tend to value uniformity and consistency over flexibility and innovation. The major problems with the current systems, as described by NIH staff, are slowness and lack of responsiveness to the needs of NIH as a research organization.

One measure of this slowness is the length of time it takes to appoint a scientist to a senior position. In the past year, NIH completed 24 appointments into the SES/SSS or equivalent positions in the U.S. Public Health Service Commissioned Corps. Six cases were in the SSS, all of which were promotions for scientists who were already at NIH. The average processing time for both promotions from within the NIH and appointments from outside, was approximately 8.5 months (NIH, 1988a).[15]

Another example of the problem with an externally controlled personnel system is shown by recent occurrences within the USERS Commissioned Corps. Policy for the corps is determined by the Surgeon General. In 1987, the Surgeon General decided to "revitalize" the corps by measures which many scientists find unsuited to the environment in which they work. These measures included: (1) rotational assignments, (2) wearing uniforms and practicing military courtesy (saluting), (3) reduction of the number of senior officers, and (4) strict enforcement of the 30-year mandatory retirement policy. Some 34 senior scientists at NIH, including the Deputy Director for the Clinical Center and a number of Branch and Lab Chiefs in the National Cancer Institute (NCI), the National Heart, Lung, and Blood Institute (NHLBI), and the National Institute of Allergy and Infectious Diseases (NIAID), received letters of mandatory retirement. After negotiations, the Surgeon General withdrew the letters; however, concern and some bitterness remains (Havermann, 1987; Specter, 1987; Kosterlitz, 1988).

The current SES/SSS system also provides examples of problems:

- The Office of the Secretary of DHHS has to approve each SES/SSS appointment.
- The Chief of Staff of DHHS required the Director of NIH to reduce the performance ratings of a number of NIH SES members, because he believed too many had been rated outstanding (although he did not require changes for members of SSS).
- The Secretary's office makes the decisions on which NIH SES/SSS members receive bonuses.
- The operation of the SES, of which SSS is a sub-part—from appointments, to the development of work plans, to rewards—is based on the assumption that its members are managers. Therefore, the rules enforced by DHHS and the Office of Personnel Management (OPM) require that scientific work be made to appear managerial.

Other examples of personnel system problems include the following:

- To recruit employees from outside of government, NIH must request a "panel of eligibles." This panel comes from OPM through the PHS and DHHS. It is reported that by the time this can occur, most people on the list have either moved from the area, found other jobs, or are no longer interested.
- When the law was enacted authorizing the Veterans Administration pay system to be used for nurses at the Clinical Center, the Secretary's office delegated the

authority to set pay levels to the Assistant Secretary for Health. Currently, the PHS has not approved the NIH request to re-delegate the authority to the Director of NIH (NIH, PHS, and DHHS, staff interviews, 1988).

## FTE Ceilings

Another major concern about the personnel system is the mandated external limitation on the number of full-time equivalent personnel. Nearly all executive branch employees are under the President's Employment Ceiling, controlled by the Office of Management and Budget (OMB). The OMB allocates FTEs to DHHS, which in turn subdivides its ceiling to the PHS, which further subdivides its ceiling between various health agencies, including NIH (NIH, 1988a; OPM, 1988). Since NIH is a part of the PHS and since the PHS has been over its ceiling, NIH has been prevented on many occasions from hiring people from the outside.

An FTE ceiling—in addition to an overall budget constraint—creates unnecessary problems, especially when there is little or no growth, low attrition rates, and constraints on the ability to remove less productive personnel. The effect of these problems on the quality and efficiency of the intramural program is difficult to assess, but the committee was convinced that effective management is inhibited.

A 1985 review of Clinical Center management issues presents some examples. The limitations on FTEs in intensive care units caused a 25 percent under-utilization of surgical units. The new ambulatory care unit faced severe problems in meeting both patient care and clinical research needs because of a shortage of FTEs. Clinical Pathology had to make the decision on whether to conduct laboratory tests in-house or contract them out, based not on appropriateness or minimizing costs, but on the availability of FTEs (NIH, 1985a). Problems in hiring technicians provide an example of the impact of FTE ceilings outside the Clinical Center.[16]

The overall effect of FTE ceilings that grow more slowly than budgets is that managers who are best placed to make decisions about how to allocate money to fulfill congressional mandates, are prevented from making the most productive decisions.

## Retirement

Another problem with the current personnel systems relates to retirement programs. Although NIH retirement programs are generous, they are not integrated with Teachers Insurance Annuity Association-College Retirement Equities Fund (TIAA-CREF) and other systems found in universities and medical schools making it extremely difficult to recruit people to NIH from academic settings. Senior DHHS and NIH officials estimate that, if the retirement systems could be made compatible, it would be much easier for NIH to recruit qualified researchers from the outside without additional costs to the government (NIH, staff interviews, 1988).

The retirement system of the commissioned corps also creates difficulties. This non-contributory system requires an individual to serve for a least 20 years in order to receive any retirement benefits, but mandates that they retire after 30 years. These provisions have both good and bad sides. The 20 years rule is a powerful incentive to remain in the organization. The 30 year rule can result in the loss of scientific leaders.

## BARRIERS TO A PRODUCTIVE WORK ENVIRONMENT

In addition to the personnel system, there are a number of other barriers that hamper NIH in accomplishing its research mission. Some of these are government-wide, others relate to NIH's location within DHHS, and still others are internal to NIH.

Recruitment and retention of staff are made more difficult by the generally low regard in which federal employees are held, both by the general public and by politicians. Both actions and rhetoric of recent administrations have had a negative impact on the federal work force. The current administration proposed a number of measures that would have adversely affect government workers—ranging from a proposed pay cut of 5 percent in 1986, to drastic cuts in retirement benefits, to increasing the retirement age from 55 to 65.

These issues are summed up in a paper entitled, The Federal Civil Service At the Crossroads, prepared for a conference on "A National Public Service for the Year 2000," jointly sponsored by the Brookings Institution and the American Enterprise Institute:

> …a growing perception among federal employees is that they are under-appreciated and under-rewarded which is affecting morale and quality of the work force at the entry level, among shortage groups, and at senior levels. The consequent erosion of the human resource capacity of the federal work force is an expected outcome of this process and raises a large question about what the future civil service will be like (Levine and Kleeman, 1986).

These attacks on federal employees have had a negative impact on NIH employees and have reduced their traditional esprit de corps. In addition, numerous recent battles with DHHS have taken a toll on NIH morale. In many ways the issue is summed up by the senior official in DHHS who said, "HHS likes to think it's a Department while NIH thinks it's special and wants to be treated differently" (NIH and DHHS, staff interviews, 1988).

Currently, NIH is one of a number of operating agencies under the PHS, which in turn is one of a group of operating divisions under DHHS. Also under DHHS structure are a number of Staff Divisions, each headed by an Assistant Secretary or the equivalent (Budget, Personnel, Legislation, Planning and Evaluation, General Counsel).

NIH has expressed the viewpoint that its organizational location creates many of the administrative barriers it faces, and that these barriers limit its capacity to achieve its mission. Even small administrative innovations can be approved only after the large and proliferating layers of bureaucracy have been persuaded. Because mid-level bureaucrats are afraid to make mistakes in interpreting guidelines and rules, decisions are bucked up from one layer to the next, a process that can take months or years.

Administrative barriers are imposed on NIH by staffs that are constantly changing and are far removed from the dynamics of biomedical research. NIH is needlessly harmed in many ways because the Director of NIH often cannot accomplish his business with the Secretary of DHHS directly and decisively (NIH, 1988b).

## Space

Many of those who responded to the committee's request for information commented on the poor laboratory and office space available to NIH scientists.[17] 'They remarked that this added to the intramural program's difficulties in retaining and recruiting staff. There is significant variation among the institutes in allotment of laboratory space per individual researcher. This would be expected, based on the differing types of research conducted, but also probably reflects luck and the timing of each institute's creation. In a 1985 study of a proposed building for the National Institute of Child Health and Human Development (NICHD), it was reported that, based on a 1983 space survey, NICHD scientists and support staff had an average of 141 square feet per person. The comparable figure for all institutes was 240 square feet (NIH, 1985b). Figures from a December 1987 space survey indicated that the average figure for all institutes has decreased to 172.3 square feet. The figure for NICHD was still the lowest, 120.4 square feet. The highest square foot figure was in the National Institute of Neurological and Communicative Disorders and Stroke (NINCDS) at 192.5, with NHLBI having 173.4 square feet, and NIAID having an average of 163.1 square feet per person. These figures represent NIH laboratory space in the Washington metropolitan area; figures for field stations are somewhat higher. Overall, NIH has slightly more than 700,000 square feet of laboratory space and 300,000 square feet of laboratory support space in the Washington area (NIH, 1987).

The problems of space have not been ignored, but improvements have been slowed by bureaucratic delays. It is estimated by NIH that construction of the new neurosciences/primate facility was delayed for nearly a year because of continuing PHS review and re-review. It is estimated that all construction or major renovation is delayed for 6 months to a year because of PHS reviews. The major renovation of the oldest laboratory buildings, called the round-robin renovation, was originally scheduled for completion in FY 1991, is expected to run until 1997. NIH officials attribute the delays to a combination of unnecessary PHS reviews and problems with appropriations. NIH staff are also bothered by what they consider PHS interference in day-to day operations. One example was that all easements—even routine ones, such as for the gas and electric companies, and even at field stations, such as those in North Carolina—have to be reviewed and signed by the PHS (NIH staff interviews, 1988).

The adequacy of current laboratory facilities is difficult to judge. Most PHS and DHHS managers interviewed believe the space to be adequate, and they point out that overcrowding is caused, in part, by the tendency of NIH to find ways around the FTE ceilings. The committee is unable to answer the question of the degree to which space problems are caused by NIH's unwillingness to set priorities and to discontinue or curtail programs and projects that are less successful.

In sum, it would appear that, based on current research programs being conducted at current levels, space is inadequate for a number of institutes and conditions have deteriorated in recent years. (Approved new construction will provide some relief with the addition of 95,000 square feet of laboratory space on campus by FY 1991 [NIH staff interviews, 1988]). Some space problems can be attributed to bureaucratic layering (and in one instance, delays more than doubled the cost of the project), and a lack of sympathy on the part of administrative people not knowledgeable about research, while other major problems include the governmental budgeting process and the political difficulties in obtaining authorization for construction in the Washington metropolitan area.

## Travel to International Conferences

Even minor bureaucratic impediments can cause frustration. Such appears to be the case with regard to travel to international conferences. DHHS centrally controls the travel of its employees to meetings in foreign countries. These controls are applied even if the agency has adequate funds to pay for the travel. This decision to control international meeting travel is not mandated by law, regulation, or outside agencies such as OMB (NIH, 1988a; NIH staff interviews, 1988).

The ceilings have not kept pace with inflation and the vastly decreased purchasing power of the dollar. From a public management perspective, it is hard to justify DHHS's disposition of a ceiling on international meeting travel, rather than holding line managers accountable for prudent use of resources that have been allocated to them. It is even harder to rationalize the current system when, not only a ceiling is imposed, but individual trips for staff at the SSS level have to be approved by the Secretary's office.

While no standards or comparisons are available, it is generally believed by the scientists that research is hampered by their inability to send appropriate numbers of scientific researchers to international meetings.

## Procurement

The general issue of government procurement has been a bane to everyone involved for many years. Contractors argue that the government is slow in processing requests, vague in its requirements, and even slower to pay its bills. Government employees needing materials complain that the process is cumbersome, laborious, and inflexible. Congress and the general public view the system with cynicism and distrust. Second only to agencies asking for relief from the government-wide personnel system are those seeking exemption from the dreaded Federal Acquisition Regulations (FAR) (Abramson, 1988; Aviation Safety Commission, 1988).

While NIH scientists feel that they, and the nation's biomedical research effort, are well served by existing procurement practices, there is some concern in the Inspector General's office of DHHS about the level of accountability and full compliance with existing regulations (DHHS, 1988). These concerns, together with recent Defense Department procurement scandals seem likely to stimulate an increased level of regulation of procurement policy. Existing procurement procedures at NIH are supportive of the research effort and provide little justification for considering privatization of the intramural research program. NIH has expressed the specific concern that excessive statutory restrictions on procurement would severely thwart the flexibility necessary to make effective use of the nation's investment in biomedical research. Although the committee shares this concern, we believe that appropriate levels of accountability can be achieved, with due allowance for the need of an effective research program, and that privatization is not a serious alternative solution to this problem.

## Summary

There is evidence that many good scientists are willing to forgo much higher earnings to enjoy the distinctive research environment at NIH, which for some, is especially conducive to research productivity and creativity. But some of the factors that contribute to this environment are subject to counterproductive, administrative controls. Notable among these are travel, support personnel, equipment, space, and procurement.

Although there is little evidence that the PHS or DHHS interferes with scientific direction at NIH, the cumulative impact of not being able to fill technician positions, of delays and endless paperwork in getting promotions, of the crowding and overall lack of space, and of a perceived lack of respect, is having a negative impact on the scientists, if not directly on the quality of the science.

The combination of increasingly burdensome and unnecessary constraints with lower salaries and less flexible administrative policies creates concern about NIH's ability to build the future staff necessary to sustain the quality and vitality of the intramural program.

## COPING WITH A CHANGING ENVIRONMENT

In addition to administrative problems caused by the subordinate organizational location of NIH, concern has also been expressed about the authority of the director to meet organization-wide responsibilities and his ability to marshal resources to plan for the future, and to respond to crisis situations and external demands.

NIH indicates that part of the problem is that the director lacks the authority to reprogram funds and to establish and administer a flexible reserve fund. The 1984 IOM study of the organization of NIH confirmed that the Director of NIH had relatively limited authority vis a vis individual institute directors. As that report stated, "authority in the NIH has became increasingly decentralized over the years for a number of reasons. The institutes have became more autonomous, with their own congressional appropriations and their own specific constituencies." Lacking budget authority, including any ability to reprogram funds to meet emergencies or opportunities, and lacking a reserve fund, it is very difficult for the director to plan and coordinate activities across institutes.

A review of previous studies of the intramural program conducted for the 1984 IOM study also identified other concerns. These included the need to review the Medical Fellows Program to ensure high quality in all institutes and the need to make managerial practices more flexible and responsive to outside initiatives. The decentralized nature of the intramural programs was said to make it difficult to coordinate NIH-wide or DHHS priorities. The decentralized appropriation structure and autonomy of the institutes often make it difficult to shift resources to respond to scientific opportunities, congressional concerns, and NIH or secretarial directives (IOM, 1984).

This lack of responsiveness may sometimes be attributable to a structure that inhibits comprehensive and decisive response. For example, NIH has received mixed reviews about its response to the Acquired Immunodeficiency Syndrome (AIDS) crisis. Many analysts have given them good marks, but others have criticized NIH for one or more of the following failures: slowness to recognize the extent and seriousness of the problem; failure to mobilize resources; failure to coordinate the responses of various institutes; and, lack of cooperation among institutes, Centers for Disease Control, and the outside research community (Panem, 1988; Stoto et al., 1988; Shilts, 1988).

In looking to the future of the intramural program, the committee found it necessary to assess the environment in which the program will operate. A number of factors indicate that today's problems are likely to be exacerbated. The demand for biomedical researchers is likely to continue to grew. The evolution of science is blurring interdisciplinary boundaries, and moving quickly in unpredictable directions. In addition, as the AIDS epidemic indicates, health emergencies occur and the strengths of individual institutes may need to be mobilized in a coordinated undertaking. Acknowledging these problems, the President's Commission on the Human Immunodeficiency Virus Epidemic (AIDS Commission), made a number of recommendations to improve the ability of NIH to respond to the AIDS crisis (Presidential Commission on the Human Immunodeficiency Virus Epidemic, 1988). Major commission recommendations include giving the Director of NIH increased authority over budget and personnel resources within NIH for a 2-year period and having him report directly to the Secretary of DHHS.

To move effectively in areas over which no one institute has a logical claim, NIH needs a capability to make and implement decisions that transcend institute lines. This capability does not exist today. The challenge is to address this problem without undermining the strengths of the current structure of independent institutes that form a confederated NIH.

## SUMMARY OF ADMINISTRATIVE PROBLEMS

The committee concluded that personnel problems, both those relating to compensation and the overall personnel system, are compromising the ability of NIH to recruit and retain scientists of the highest quality. The committee found that, in selected areas, NIH salaries are not competitive, particularly for physician researchers and overall for those at the most senior levels. Although federal salaries in general lag behind the private sectors, this is less of a problem for NIH than the fact that the system lacks the flexibility necessary to compete in a tight labor market. While the committee would like to see appropriate pay compatibility for federal workers, and hopes that the efforts of the Quadrennial Commission and the Volker Commission will be successful,[1 8] it is convinced that it is also important for NIH to have the flexibility necessary to compete for key individuals and necessary categories of support personnel.

Administrative problems are not so serious as to require drastic changes. However, they are serious enough to require consideration of a greater delegation of authority to NIH from DHHS and the PHS. Vigilance is needed to assure that these administrative problems do not reduce the traditional esprit of NIH to the extent that it is no longer able to retain its large pool of dedicated researchers. The committee finds that, taken as a whole, these problems call for action on the parts of Congress, the Department of Health and Human Services, and the National Institutes of Health. The question for discussion in the next chapter is what type of actions, structural or specific, make sense given the scope and nature of the problems.

# ENDNOTES

1. Serious concern over NIH salaries has been expressed in many reports, including the report of the President's Biomedical Research Panel, (1976) ; The Federal Laboratory Review Panel (Packard Committee) 1983; and two internal NIH committees, the Committee on Pay and Personnel Systems in Intramural Research (Eberhart Committee), 1981 and the Committee on Pay of Scientists (Chen Committee), 1982.

2. The issue of quality makes this assessment more difficult. NIH not only requires the ability to employ an adequate number of investigators, but these investigators must be capable of performing independent research of high quality. Chapter 2 addresses the issue of quality at NIH and indicates that, while the committee believes that the intramural program is one of the nation's important centers of biomedical science, it is unable to determine how deeply the highest level of quality pervades the organization. While there is significant evidence of scientific excellence, the committee believes that further improvements in quality can be maintained only if the pool of scientists remains strong.

3. Table 3-3 provides more detailed information on all programs used to recruit non-tenured scientists for the period 1983–1987. Because the Medical Staff Fellow Program, which began in 1981, lasts for 3 years, the first conversions occur in 1984 (Table 3-6b). The rate of conversion has been relatively low—ranging between 1 percent and 3.6 percent, with the lowest rates occurring in the last 2 fiscal years. (However, a number of M.D.s progress from the Medical Staff Fellowship Program to the Senior Staff Fellowship Program before being considered for tenure). Most conversions are from the Senior Staff Fellowship Program, individuals with 3–7 years postdoctoral experience, and are made at the GS/GM-13 level. A few conversions, primarily M.D.s, are made at the GS/GM-14 level and a few are made into the Public Health Service Commissioned Corps—normally at the CO-3 or CO–4 levels. The reduction in the number of fellows going into the corps in the last two years is probably attributable to both changes in corps assignment patterns, which make it less desirable for someone interested in a biomedical research career, and to the elimination of the clinical associate program.

4. References to physicians or M.D.s in the tables and text include M.D.s, doctors of osteopathy (D.O.s), and those M.D.s and D.O.s who also have a Ph.D. References to Ph.D.s in the tables and text include small numbers of individuals with other doctorates. These include dentists, veterinarians, podiatrists, and those with doctoral degrees in fields, such as pharmacy and public health, and those with equivalent foreign degrees.

5. There is a fundamental difference in the meaning of tenure between NIH and academia. In universities, the tenure clock does not begin to tick until the faculty member has completed postdoctoral training and has been given his/her initial faculty appointment. In contrast, at NIH, the clock begins to tick at the time the individual enters into postdoctoral training. As Table 3-4 describes, for some researchers who begin their postdoctoral careers at NIH, the time to tenure may extend up to 10 years; however, this is not true for the majority of researchers. NIH does not currently have information of the average time it takes to receive tenure. Some senior staff members estimate the average is 7 years, while others believe it is closer to 4 years. The committee suggests it would be useful for NIH to review systematically its actual experience with tenure.

In general, in making comparisons between NIH and universities, it is important to remember that the GS-13 senior investigator position at NIH is tenured, while the assistant professor position at a university is not.

6. Several peculiarities pertaining to these data should be noted. The conversion rates appear artificially low, because the NIH personnel data system does not have the ability to track a cohort of new appointees through the system until they receive tenure or leave NIH. The conversion rate shown is, therefore, a synthetic one derived by dividing the number converted during a given fiscal year by the total number of fellows on board at the beginning of that fiscal year. Because fellows are employed for a number of years, it is likely that the true conversion rate is significantly higher. In addition, most visiting associates and visiting scientists, because they are foreign nationals, are not eligible for permanent appointments at NIH. In spite of these caveats, the data provide useful insights into the ability of NIH to retain younger researchers. This is particularly true for the trend data for staff fellows, including senior staff fellows, because comparable data are available for most years back to 1975.

7. This comparison must be used with caution, since the definition of instructor varies considerably among medical schools, and therefore lacks internal consistency. Most basic science departments do not use the title, but instead activate a faculty members initial appointment as assistant professor. In many clinical departments, the title is used for clinicians and not researchers. With these cautions, the information does allow another limited comparison of the competitiveness of NIH salaries for beginning researchers.

8. The intramural program mid-level workforce is indeed aging. The average age of physicians went from 42.8 years in 1983 to 45.6 years in 1988, and Ph.D. scientists went from 46.1 years to 47.6 years over the same period. There are a number of potential explanations for these changes; the overall

U.S. population and the overall federal workforce is aging. The average age of both M.D. and Ph.D. faculty in U.S. medical schools has increased slowly for a number of years (Jolly, 1986). Besides these general considerations, there are specific programmatic factors that may effect the increasing average age of researchers at NIH (especially M.D.s). As Table 3-8 shows, there is a significant reduction in the number of M.D.s in grades C0-4 and C0-5, and a major increase in the number of C0-6s. This probably is caused by phasing out the Clinical Associates Program, which recruited people into the corps, and its replacement by the Medical Staff Fellowship Program, which recruits into the Civil Service. The change may be accounted for, in part, by the creation of new fellowship programs, such as IRTA, which allow researchers to spend up to 10 years at NIH before they receive tenure. This is important to the issue of age, since the changing age distribution is based on permanent staff, and does not include fellows.

Data on researchers who left NIH (Table 3-9) show much less clear direction, especially for physicians, possibly representing the fact that the much smaller numbers are more subject to random events. In some years, the average age of physicians leaving NIH has been younger than those remaining and in some years, older, with no discernible trend. The same is true with regard to their years of experience at NIH. With regard to Ph.D.s, although the average age at departure has fluctuated with no specific trend, those leaving have been significantly older each year than those who remain.

The reasons for, or the impacts of, the aging of the research scientists are not clear; the magnitude of the shifts, particularly with regard to physicians, warrants continued monitoring and analysis by NIH.

9. Included in this group are 32 individuals (GS-13 to -15) originally brought to NIH from outside on special time-limited appointments, and then converted to permanent positions.

10. The complexities of making comparisons across organizations increase significantly when the attempt is made to compare total benefits (base pay plus bonuses, allowances, retirement benefits, health insurance benefits, life insurance benefits, and leave benefits). The Office of Personnel Management uses the figures 23–26 percent of base pay as the value of the benefit package for the general federal workforce. A representative of the American Association of University Professors estimates that the benefits package for universities averages 22–23 percent of salary. In a 1987 National Compensation Survey of Research and Development Scientists and Engineers, done by the Hay Management Group for the Department of Energy, the benefits package for government contract laboratories was determined to be 32.8 percent of salaries, and the comparable figure for private and academic laboratories was 29.1 percent. Because of the difficulties in determining total benefits, comparisons are made on base salaries unless specified.

11. NIH has for many years compared its salaries for GS-13s -14s, -15s with Assistant, Associate, and full Professors in medical schools, and has made the comparison for Ph.D.s in basic science departments and for M.D.s in clinical science departments. These comparisons are not based on an analysis of functions and duties, but on reasonableness, e.g., NIH and medical schools both have three levels of independent researchers above the level of postdoctorate and below the management level (SSS/C0-7 level of NIH and department chairman in medical schools). In addition to showing salary comparisons for M.D.s in all clinical departments, comparisons are also made with faculty in departments of medicine and pediatrics. These departments were chosen because they represent the specialties of a majority of the full-time permanent M.D.s at NIH. Based on July, 1988 data, 47 percent of NIH M.D.s specialized in internal medicine, including subspecialties and 11 percent in pediatrics, including subspecialties. The AAMC annual report on faculty salaries defines base compensation as compensation that is fixed by the institution, exclusive of fringe benefits, and normally not influenced by practice earnings. Most of the comparisons for M.D.s are with this figure, since NIH M.D.s do not have comparable practice earnings.

12. Including both direct appointments and the conversion of time-limited appointments to tenured positions.

13. Forty-two senior scientists have left NIH for positions in academic institutions, industry, and independent research laboratories at salary increases ranging from 50 to 300 percent. One NIH deputy director and five institute directors accepted employment in major academic institutions with salary increases ranging from 80 to 276 percent. Chiefs of surgical branches in two institutes, each paid at the maximum federal salary level, were recruited in 1985 and 1986 at almost triple their federal compensation. One accepted a position at a large cancer center in the South at $200,000—an increase of 191 percent; the other accepted a position at an eastern medical school at $212,500—a 219 percent salary increase. In both instances the scientists received fringe benefits at least equal to those paid by the federal government.

A similar list could be developed for those medical schools who lost superstar faculty to other institutions; however, a key difference is that NIH is not able to recruit replacements of similar stature from the outside.

14. Secretaries are currently paid above the set rate for their grade in the Washington Metropolitan area because federal salaries are not competitive. In spite of this special pay, NIH reports a large number of vacancies for secretaries. In interviews with NIH scientists, frequent reference was made to the difficulty in recruiting and retaining secretaries.

15. This is the time for processing the request through the personnel system after decisions concerning the action have been made by the institute.

16. A number of scientists at NIH stated during interviews that they had severe problems with the quality and availability of technicians. They indicated that these problems were caused by inadequate salaries (qualified technicians left for higher paying jobs on the outside), and that because of FTE ceilings, they were forced to hire from within the PHS and could not recruit on the open market for the best qualified technicians.

17. The problem of adequate space for the intramural research program is of long standing. A 1981 NIH paper on the renovation of six key laboratory buildings traces concerns back to 1966. The paper describes the buildings as a public health hazard which did not meet the regulations required of NIH grantees with regard to occupational safety and health. In addition to safety inadequacies, their support systems and interior architectural features were described as obsolete and deteriorated. The paper goes on to state:

It is clear that there is a dire need to renovate these buildings. The renovation has been put off from year to year since 1966, when the need for this work was first recognized. It can be put off no longer. We have gone beyond the point at which we fear for the consistency of the experimental results; we have passed the stage of worrying about whether the machines will function properly. The poor conditions for housing animals, the barriers to the handicapped, and other problems normally of serious concern to us have all become relatively minor, compared with the jeopardy to personnel now working in these obsolete facilities" (NIH, 1981).

The renovation of these facilities was designed as a coordinated 11 year effort to be completed by FY 1991 at a construction cost of $45 million. However, budget problems and extended bureaucratic reviews have already extended the estimated completion date by six years and construction costs have increased to approximately $95 million (NIH staff interviews, 1988).

18. The National Commission on the Public Service, chaired by Paul Volker, was created March 2, 1987 to explore the problems of attracting and retaining talented individuals for careers in the federal government. The commission's final report is scheduled for release in early February, 1989. The Commission on Executive, Legislative, and Judicial Salaries (The Quadrennial Commission), originally established by Sec. 225 of P.L. 90-206, is charged with reviewing and making recommendations to the President on the compensation of senior federal executives. The report of the current commission is due to be submitted to the President by December 15th of this year.

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TABLE 3-1a Personnel Systems Under Which NIH Tenured Scientists Are Employed

General Schedule (GS)

The General Schedule is the primary personnel system used throughout the federal government for the employment of civilians. The GS system is divided into 15 pay grades, from a low of GS-1 to a high of GS-15. Positions requiring managerial or supervisory duties are designated General Managerial (GM) at grades 13 through 15. Grade levels are established according to standards developed by the U.S. Office of Personnel Management (OPM). These standards prescribe progressively more difficult duties and responsibilities at successively higher grade levels....

Initial entry into the GS/GM system is competitive, and all individuals must be certified as qualified and eligible by OPM before they can be appointed by an agency. Most doctoral-level scientists appointed to permanent positions will be assigned responsibility for the supervision of a laboratory or a research team, they are usually designated as GM. Depending upon their qualifications and the duties and responsibilities of the position, some doctoral-level scientists are appointed at grades GM-14 or GM-15 level.

Pay for GS/GM employees is jointly determined on an annual basis by the Congress and the Executive Branch.... Special pay rates are also established for occupational groups that OPM determines to be shortage categories for recruitment and retention purposes. At the GM-13 through GM-15 level, medical officers are the only scientific occupation utilized by NIH determined to be a shortage category.... There is a statutory limit on the amount of base salary that can be paid to GS/GM employees (currently $75,500), regardless of their occupation or pay schedule.

GS/GM physicians may also receive a Physicians Comparability Allowance (PCA). This is a recruitment and retention allowance that agencies may use to supplement the salaries of physicians, in exchange for an agreement to remain in the federal service for one to three years. Authority to pay PCA allowances is subject to a plan approved by the OMB....

**TABLE 3-1a, Continued Personnel Systems Under Which NIH Tenured Scientists Are Employed**

NIH is authorized to pay PCA allowances to GS/GM and SES/SSS physicians. Since PCA is a salary supplement, it may be paid in excess of the statutory limit on GS/GM salaries. PCA allowances are graduated according to grade level and research accomplishments. Recent legislative changes and OMB approval have led to an increase in the maximum PCA allowance from $10,000 to $20,000 a year. However, not all physicians receive the maximum PCA allowance. Compensation data provided on NIH physicians includes both salary and PCA allowance.

Senior Executive Service and Senior Scientific Service (SES/SSS)

The SES/SSS is the mechanism available for the employment of the highest level civilians.... Although intended to be a system for senior managers, scientists above the GS/GM-15 level with significant supervisory and program responsibility are also eligible for inclusion. All appointments or promotions to the SES/SSS are competitive.

The SES/SSS is an ungraded personnel system with six pay levels that may be adjusted annually. Pay for the SES/SSS is jointly determined by the Congress and the Executive Branch, and raises do not always occur annually. With few exceptions most NIH scientists are limited to a maximum salary at the fourth pay level (currently $73,400). Physicians in the SES/SSS system are also eligible for PCA allowances up to a maximum of $20,000. Total compensation in this system (salary, PCA allowances, and performance bonuses) is subject to a statutory limit, currently $99,500.... Data provided on the compensation of NIH SES/SSS physicians include salary and PCA.

Both the GM and SES/SSS systems have a mechanism for awarding performance bonuses. GM employees who receive annual performance ratings of Outstanding must receive performance bonuses of at least 2 percent of base pay. GM employees who receive annual performance ratings of Excellent or Fully Satisfactory may receive performance bonuses of lesser amounts. These awards are not subject to the statutory limit on pay. Approximately one-third of the NIH members of the SES/SSS receive bonuses each

TABLE 3-1a, Continued Personnel Systems Under Which NIH Tenured Scientists Are Employed

year averaging 7 percent of base pay. In addition, a few members of the SES/SSS may receive Presidential Rank Awards of either $10,000 or $20,000 each year for outstanding career performance. Both performance and Rank Awards for members of the SES/SSS are subject to the statutory limit on total compensation....

U.S. Public Health Service Commissioned Corps (PHS)

The PHS Commissioned Corps is a career uniformed service, with pay and benefits comparable to the armed services.

Officers' grades and ensignia parallel those of the armed services. Grades 0-4, 0-5, and 0-6 are considered to be equivalent to GS-13, GS-14, and GS-15, respectively. Officers at grades 0-7 and 0-8 are equivalent to appointees in the SES. Unlike civil servants, the grade and pay of commissioned officers is based on the "rank-in officer" concept, awarding credit for years of creditable education and subsequent professional experience. Promotions are competitive, following completion of higher levels of training and experience.

Compensation has several components, depending on the officer's professional category and status, including (1) basic pay, reflecting grade and years of service; (2) nontaxable quarters allowance, based on grade and with or without dependents, (3) nontaxable Variable Housing Allowance cost-of-living supplement for geographical location; (4) nontaxable subsistence allowance; (5) Variable Special Pay for medical officers; (6) Retention Special Pay for medical officers who sign one to four-year contracts to remain on active duty; (7) Additional Special Pay for dental officers who sign annual contracts to remain on active duty; and (8) Board Certified Pay for board certification in a medical or dental specialty. Pay increases are jointly determined by Congress and the Executive Branch on an annual basis.

Officers are eligible for and may request retirement following 20 years of service, and must retire after 30 years of service.

SOURCE: NIH, Office of Associate Director for Administration (1988)

TABLE 3-1b Salary Rates for Permanent NIH Scientists Under the General Schedule and Senior Executive Service

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| GS-1 | $9,811 | $10,139 | $10,465 | $10,791 | $11,117 | $11,309 | $11,631 | $11,955 | $11,970 | $12,275 |
| 2 | 11,032 | 11,294 | 11,659 | 11,970 | 12,103 | 12,459 | 12,815 | 13,171 | 13,527 | 13,883 |
| 3 | 12,038 | 12,439 | 12,840 | 13,241 | 13,642 | 14,043 | 14,444 | 14,845 | 15,246 | 15,647 |
| 4 | 13,513 | 13,963 | 14,413 | 14,863 | 15,313 | 15,763 | 16,213 | 16,663 | 17,113 | 17,563 |
| 5 | 15,118 | 15,622 | 16,126 | 16,630 | 17,134 | 17,638 | 18,142 | 18,646 | 19,150 | 19,654 |
| 6 | 16,851 | 17,413 | 17,975 | 18,537 | 19,099 | 19,661 | 20,223 | 20,785 | 21,347 | 21,909 |
| 7 | 18,726 | 19,350 | 19,974 | 20,598 | 21,222 | 21,846 | 22,470 | 23,094 | 23,718 | 24,342 |
| 8 | 20,739 | 21,430 | 22,121 | 22,812 | 23,503 | 24,194 | 24,885 | 25,576 | 26,267 | 26,958 |
| 9 | 22,907 | 23,671 | 24,435 | 25,199 | 25,963 | 26,727 | 27,491 | 28,255 | 29,019 | 29,783 |
| 10 | 25,226 | 26,067 | 26,908 | 27,749 | 28,590 | 29,431 | 30,272 | 31,113 | 31,954 | 32,795 |
| 11 | 27,716 | 28,640 | 29,564 | 30,488 | 31,412 | 32,336 | 33,260 | 34,184 | 35,108 | 36,032 |
| 12 | 33,218 | 34,325 | 35,432 | 36,539 | 37,646 | 38,753 | 39,860 | 40,967 | 42,074 | 43,181 |
| 13 | 39,501 | 40,818 | 42,135 | 43,452 | 44,769 | 46,086 | 47,403 | 48,720 | 50,037 | 51,354 |
| 14 | 46,679 | 48,235 | 49,791 | 51,347 | 52,903 | 54,459 | 56,015 | 57,571 | 59,127 | 60,683 |
| 15 | 54,907 | 56,737 | 58,567 | 60,397 | 62,227 | 64,057 | 65,887 | 67,717 | 69,547 | 71,377 |
| 16 | 64,397 | 66,544 | 68,691 | 70,838 | 72,500 | 73,660* | 75,765* | 77,870* | 79,975* | |
| 17 | 73,958* | 76,423* | 78,888* | 81,353* | 83,818* | | | | | |
| 18 | 86,682* | | | | | | | | | |

* The rate of basic pay payable to employees at these rates is limited to the rate for level V of the Executive Schedule, which is currently $72,500.

**SENIOR EXECUTIVE SERVICE**

| | |
|---|---|
| ES-1 | $65,994 |
| 2 | 68,952 |
| 3 | 71,910 |
| 4 | 73,400 |
| 5 | 75,500 |
| 6 | 77,500 |

**EXECUTIVE SCHEDULE**

| | |
|---|---|
| level I | $99,500 |
| II | 89,500 |
| III | 82,500 |
| IV | 77,500 |
| V | 72,500 |

SOURCE: NIH, Office of Associate Director for Administration (1988)

TABLE 3-2 NIH Fellows by Title and Degree as of End of Fiscal Years 1983-1988

| TITLE | SEPT. 30, 1983 | | | SEPT. 30, 1984 | | | SEPT. 30, 1985 | | | SEPT. 30, 1986 | | | SEPT. 30, 1987 | | | MAY 21, 1988 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M.D. | Ph.D. | TOTAL | M.D. | Ph.D. | TOTAL | M.D. | Ph.D. | TOTAL | M.D. | Ph.D. | TOTAL | M.D. | Ph.D. | TOTAL | M.D. | Ph.D. | TOTAL |
| STAFF FELLOW | 11 | 299 | 310 | 19 | 302 | 321 | 14 | 273 | 287 | 18 | 227 | 245 | 31 | 213 | 244 | 33 | 209 | 242 |
| SR. STAFF FLW. | 47 | 173 | 220 | 73 | 201 | 274 | 86 | 209 | 295 | 100 | 223 | 323 | 124 | 250 | 374 | 111 | 247 | 358 |
| EPIDEMIOLOGY S.F. | 0 | 0 | 0 | 2 | 0 | 2 | 8 | 0 | 8 | 10 | 0 | 10 | 7 | 0 | 7 | 7 | 0 | 7 |
| MEDICAL STAFF FLW. | 334 | 0 | 334 | 331 | 0 | 331 | 310 | 0 | 310 | 295 | 0 | 295 | 293 | 2 | 295 | 279 | 2 | 281 |
| DENTAL STAFF FLW. | 0 | 5 | 5 | 0 | 7 | 7 | 0 | 5 | 5 | 0 | 4 | 4 | 0 | 5 | 5 | 0 | 5 | 5 |
| VISITING ASSOCIATE | 70 | 111 | 181 | 80 | 126 | 206 | 67 | 122 | 189 | 62 | 114 | 176 | 103 | 147 | 250 | 124 | 173 | 297 |
| VISITING SCIENTIST | 36 | 81 | 117 | 31 | 71 | 102 | 37 | 68 | 105 | 39 | 66 | 105 | 49 | 75 | 124 | 49 | 85 | 134 |
| GRAND TOTAL | 498 | 669 | 1,167 | 536 | 707 | 1,243 | 522 | 677 | 1,199 | 524 | 634 | 1,158 | 607 | 692 | 1,299 | 603 | 721 | 1,324 |

NOTE: M.D. figures include M.D.s, D.O.s and those with both M.D. and Ph.D. Ph.D.s include a few researchers with other doctorates, e.g., D.D.S., D.V.M., D.P.H., and some equivalent foreign degrees.

SOURCE: NIH, Office of Associate Director for Administration (1988)

TABLE 3-3 NON-TENURED INTRAMURAL EMPLOYMENT (FTE POSITIONS)

| | STAFF FELLOWS/SENIOR STAFF FELLOWS (Ph.D.) | MEDICAL STAFF (Includes Dental Staff Fellows, Epidemiology Staff Fellows | VISITING ASSOCIATES VISITING SCIENTISTS |
|---|---|---|---|
| CONCEPTS AND PURPOSE | Provide employment and professional development of promising postdoctoral research scientists. | Provide initial employment and research training to junior level physicians. | Provide for an international interchange of scientific information and training. |
| NATURE OF ASSIGNMENTS | Perform basic and/or clinical research. May not engage in supervisory of administrative activities. | Laboratory research and/or patient care supportive of research protocols. | Conduct basic and applied research related to health. |
| QUALIFICA-TIONS | M.D. degree or Ph.D. in biomedical, behavioral, or related science and postdoctoral research experience: 0-3 years for Staff Fellows and 3-7 years for Senior Staff Fellows. | M.D. degree plus 2-3 years graduate medical training. | M.D. degree in health sciences and postdoctoral research experience or training: 3 or more years for Visiting Associates and 6 or more years for Visiting Scientists. |
| DURATION OF APPOINTMENT | 2 year initial appointment, extension in yearly increments to maximum of 5 years. Sixth and seventh years by exception mechanism. | 2-3 year initial appointment up to 3 year maximum. | 12-13 month initial appointment, · extensions in 1 year increments to a maximum of 4 years. |
| STIPEND LEVELS | Staff Fellow (Ph.D.) \$20,000 - \$38,753<br>Staff Fellow (M.D.) \$24,000 - \$36,588<br>Senior Staff Fellow (Ph.D.): \$24,000 - \$43,452<br>Senior Staff Fellows (M.D.): \$28,000 - \$50,744 | \$32,000 - First Year<br>\$34,000 - Second Year<br>\$36,000 - Third Year | Visiting Associates \$22,907 - \$43,181 (GS-9/1 - GS-12/10) (rounded to nearest \$1,000).<br>Visiting Scientists: \$33,218 - \$75,500 (GS-12/1 - Pay Cap) (rounded to nearest \$1000). |

TABLE 3-3 CONTINUED, NON-TENURED INTRAMURAL EMPLOYMENT (NON-FTE POSITIONS)

| | VISITING FELLOWS | IRTA FELLOWS | NRSA FELLOWS | NRC - NIH RESEARCH ASSOCIATESHIP PROGRAM IN BIOTECHNOLOGY |
|---|---|---|---|---|
| CONCEPTS AND PURPOSE | Provide postdoctoral research training and international interchange. | Provide advanced training and research experience to M.D. and Ph.D. level investigators at beginning of their research careers. | Provide training in specified areas of biomedical and behavioral research. | Provide research opportunities in biotechnology. |
| NATURE OF ASSIGNMENTS | Research training only. May not perform services for NIH or administrative duties. | Engage in research studies under the direction of preceptors and participate in ongoing research. Primary patient care activities not permitted. Service to NIH expected as by product of research assignment. | Research training in a specified area of research. Service to NIH not permitted. Clinical duties must be confined to those that are part of the research training. | Full time research on the problem outlined in the candidate's Research Proposal. Clinical activities not envisioned. |
| QUALIFICATIONS | M.D., Ph.D., or other doctorate in health sciences and less than 3 years postgraduate research experience. | M.D., Ph.D., or other doctorate in biomedical, behavioral, or related science and less than 3 years postgraduate research experience. | M.D., Ph.D., or other doctorate. | M.D., Ph.D., or other doctorate in related discipline, and 5 years or less relevant postdoctorate research experience. |
| DURATION OF APPOINTMENT | Initial award for 1 year, extensions in yearly increments to maximum of 2 years. Extensions subject approval of OD/NIH & Naturalization Service. | Initial award for 1 year, extensions in yearly increments to maximum of 3 years. Initial award approved by Assoc. Dir. for Intramural Affairs or Dep. Dir. for Intramural Research; extensions by BID Sci. Dir. | Initial award for 1 year, extensions in 12 month increments up to maximum of 3 years. Activation Notice and Payback Agreement required at beginning of each extension. | Initial award for 1 year, extentions in one year increments to maximum of 3 years. |
| STIPEND LEVELS | $20,000 - 0-1 year<br>$21,500 - 1-2 years<br>$23,000 - 2-3 years | $20,000 - 0-1 year<br>$21,500 - 1-2 years<br>$23,000 - 2-3 years | $15,996 - 0 years exp.<br>$17,004 - 1 year exp.<br>$21,996 - 2 years exp.<br>$23,004 - 3 years exp.<br>$24,000 - 4 years exp.<br>$26,004 - 5 years exp.<br>$27,996 - 6 years exp.<br>$30,000 - 7 or more yrs<br>(5% inc. proposed) | Regular Associate:<br>$27,150 - $35,000<br>Sr. Associate:<br>$35,000 - $68,000<br>(Paid by National Research Council.) |

Note: Modification of material supplied to NIAID Board of Scientific Counselors.
Source: NIAID (1988).

TABLE 3-4 TIME LINE FOR TRAINEES AT NIH

Scientists usually have seven years at NIH to get tenure; however, some scientists who begin their research careers at NIH may have up to ten years. The time line shown below is an example of how scientists may spend their postdoctoral years at NIH. There is some flexibility in the utilization of the slots (e.g., a Senior Staff Fellows and Visiting Associates positions may be utilized up to the tenure appointment).

| 3 Years | 3 Years | 2 Years | 2 Years | TENURE |
|---|---|---|---|---|
| Intramural Research Training Awards | Medical Staff Fellow | Senior Staff Fellow | PHS Commissioned Corps | |
| National Research Science Awards | Staff Fellow | Visiting Scientist | (Time Limited Appt) | |
| National Research Council | Visiting Associate | | (Time Limited Appt) | |
| Visiting Fellow | | | Expert+ | |

+ Expert positions can be used up to five years, but conversion to tenure is not supposed to result from the Expert position.

NOTE: Modification of Material supplied to NIAID, Board of Scientific Councilors.

SOURCE: NIAID (1988)

TABLE 3-5 National Institutes of Health Medical Staff Fellowship Program Statistics 1977 - 1988

| | Applications Distributed On Request | Applications Completed | Applicants Interviewed | Applicants Matched | Percent Matched |
|---|---|---|---|---|---|
| 1977 | 1,180 | 242 | 162 | 90 | 56% |
| 1978 | 850 | 203 | 141 | 75 | 53% |
| 1979 | | No Statistics Available | | | |
| 1980 | 1,734 | 282 | 162 | 78 | 48% |
| 1981 | 2,233 | 277 | 184 | 73 | 40% |
| 1982 | 2,233 | 310 | 204 | 81 | 40% |
| 1983 | 2,152 | 350 | 203 | 85 | 42% |
| 1984 | 2,059 | 356 | 210 | 90 | 43% |
| 1985 | 2,351 | 370 | 245 | 78 | 32% |
| 1986 | 2,427 | 306 | 188 | 56 | 30% |
| 1987 | 1,361 | 294 | 213 | 83 | 39% |
| 1988 | 1,280 | 187 | 155 | 76 | 49% |

SOURCE: NIH, Medical Staff Fellowship Program (1988)

TABLE 3-6a RATES OF CONVERSION OF NIH STAFF FELLOWS TO PERMANENT GS AND CO APPOINTMENTS

| Fiscal Year | No. of SF/SSFs on Board @ Start of FY | No. Converted During FY | Rate of Conversion (Col 3 - Col 2) |
|---|---|---|---|
| 1975 | 323 | 21 | 6.5% |
| 1976 | 360 | 31 | 8.6% |
| 1977 | 350 | 31 | 8.9% |
| 1978 | 378 | 29 | 7.7% |
| 1979 | 436 | 41 | 9.4% |
| Average | 369.4 | 30.6 | 8.3% |
| 1980 | 453 | 22 | 4.9% |
| 1981 | 460 | 23 | 5.0% |
| Average | 456.5 | 22.5 | 4.9% |
| 1983 | 467 | 11 | 2.4% |
| 1984 | 530 | 23 | 4.3% |
| 1985 | 597 | 24 | 4.0% |
| 1986 | 590 | 24 | 4.1% |
| 1987 | 578 | 33 | 5.7% |
| Average | 552.4 | 23 | 4.2% |

SOURCE: NIH, Office of Associate Director for Administration (1988)

TABLE 3-6b Conversions of NIH Fellows to Full-Time Permanent Appointments in General Schedule (GS/GM), Commissioned Corps (CO) Positions. Fiscal Years 1983-1987.

| Fellowship Programs | Fellows at Start of FY 1983 | Converted to GS/GM/CO FY 1983 | | Fellows at Start of FY 1984 | Converted to GS/GM/CO FY 1984 | | Fellows at Start of FY 1985 | Converted to GS/GM/CO FY 1985 | | Fellows at Start of FY 1986 | Converted to GS/GM/CO FY 1986 | | Fellows at Start of FY 1987 | Converted to GS/GM/CO FY 1987 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | # | % | | # | % | | # | % | | # | % | | # | % |
| STAFF FELLOW PROGRAM | | | | | | | | | | | | | | | |
| Staff Fellows | 271 | 2 | 0.7% | 310 | 2 | 0.6% | 321 | 1 | 0.3% | 287 | -- | ---- | 245 | 1 | 0.4% |
| Senior Staff Fellows | 196 | 9 | 4.6% | 220 | 21 | 9.5% | 274 | 22 | 8.0% | 295 | 23 | 7.8% | 323 | 32 | 9.9% |
| Epidemiology Staff Fellows | --- | -- | ---- | --- | -- | ---- | 2 | 1 | 50.0% | 8 | 1 | 12.5% | 10 | -- | ---- |
| Subtotal | 467 | 11 | 2.4% | 530 | 23 | 4.3% | 597 | 24 | 4.0% | 590 | 24 | 4.1% | 578 | 33 | 5.7% |
| MEDICAL STAFF FELLOW PROGRAM | | | | | | | | | | | | | | | |
| Medical Staff Fellows | 260 | -- | ---- | 334 | 10 | 3.0% | 331 | 14 | 4.2% | 310 | 3 | 1.0% | 295 | 5 | 1.7% |
| Dental Staff Fellows | 3 | -- | ---- | 5 | -- | ---- | 7 | -- | ---- | 5 | -- | ---- | 4 | -- | ---- |
| Subtotal | 263 | -- | ---- | 339 | 10 | 2.9% | 338 | 14 | 4.1% | 315 | 3 | 1.0% | 299 | 5 | 1.7% |
| VISITING PROGRAM | | | | | | | | | | | | | | | |
| Visiting Associates | 124 | 1 | 0.8% | 181 | 1 | 0.6% | 206 | -- | ---- | 189 | -- | ---- | 176 | -- | ---- |
| Visiting Scientists | 99 | 1 | 1.0% | 117 | 6 | 5.1% | 102 | 2 | 2.0% | 105 | 2 | 1.9% | 105 | 3 | 2.9% |
| Subtotal | 223 | 2 | 0.9% | 298 | 7 | 2.3% | 308 | 2 | 0.6% | 294 | 2 | 0.7% | 281 | 3 | 1.1% |
| TOTAL | 953 | 13 | 1.4% | 1,167 | 40 | 3.4% | 1,243 | 40 | 3.2% | 1,199 | 29 | 2.4% | 1,158 | 41 | 3.5% |

NOTE: Percentages are the number of conversions divided by staff at the start of the years.

SOURCE: NIH, Office of Associate Director for Administration (1988).

TABLE 3-7 Grades Within Senior Investigator Category

| PHS Rank | Civilian Equivalent | NIH Position | University Equivalent |
|---|---|---|---|
| — | GS 12 | Senior Technicians<br>Beginning Sr. Invest.* | Instructor |
| 04 | GS 13 | Senior Invest.<br>(Tenure) | Asst. Prof.<br>(Tenure) |
| 05 | GS 14 | Senior Invest.<br>Some Section Heads+ | Assoc. Prof. |
| 06 | GS 15 | Senior Invest.<br>Some Section Heads<br>Some Lab Chiefs** | Professor |
| 07 | SSS^ | Some Lab Chiefs<br>Some Directors IRPs<br>Institute Directors | Senior Prof.<br>Chairman |

* Senior Investigator: May or may not be a tenured position. Implies independence.

\+ Section Head: Independent investigator overseeing a group of scientists. Must be a tenured scientist.

** Laboratory Chief: Oversees group of scientists, usually a group of sections.

^ SSS: Senior Scientific Service.

NOTE: Modification of Material Supplied to NIAID, Board of Scientific Councilors.

SOURCE: NIAID (1988)

TABLE 3-8 SELECTED EMPLOYMENT DATA FOR CURRENT FULL-TIME PERMANENT NIH TENURED SCIENTISTS IN INTRAMURAL POSITIONS BY GRADE (SSS, GS/GM 13-15, CO 4-7) DATA AS OF SEPTEMBER 1983

| | M.D. | | | | Ph.D. | | | |
|---|---|---|---|---|---|---|---|---|
| PAYPLAN/ GRADE | CURRENT FTP STAFF | AVG YRS AT NIH | AVG AGE | AVG SALARY (INCL PCA) | CURRENT FTP STAFF | AVG YRS AT NIH | AVG AGE | AVG SALARY (INCL PCA) |
| SSS | 27 | 15.8 | 57.4 | 71,763 | 66 | 21.6 | 56.9 | 63,626 |
| SUBTOTAL | 27 | 15.8 | 57.4 | 71,763 | 66 | 21.6 | 56.9 | 63,626 |
| GS/GM-15 | 49 | 10.3 | 47.8 | 68,954 | 118 | 17.0 | 50.6 | 57,017 |
| GS/GM-14 | 38 | 8.9 | 43.6 | 60,938 | 172 | 13.7 | 46.3 | 47,660 |
| GS/GM-13 | 8 | 9.3 | 42.7 | 52,306 | 178 | 12.1 | 44.0 | 40,178 |
| SUBTOTAL | 95 | 9.7 | 45.7 | 64,346 | 468 | 13.9 | 46.5 | 47,173 |
| CO-7 | 2 | 32.0 | 59.0 | 54,669 | 0 | .0 | .0 | 0 |
| CO-6 | 152 | 13.3 | 46.6 | 43,200 | 44 | 18.0 | 48.7 | 44,628 |
| SUBTOTAL | 154 | 13.5 | 46.8 | 43,349 | 44 | 18.0 | 48.7 | 44,628 |
| CO-5 | 103 | 6.9 | 37.9 | 32,548 | 23 | 9.1 | 39.1 | 32,988 |
| CO-4 | 36 | 3.3 | 32.8 | 26,461 | 12 | 6.0 | 35.4 | 26,614 |
| SUBTOTAL | 139 | 5.9 | 36.6 | 30,972 | 35 | 8.1 | 37.8 | 30,803 |
| TOTAL | 415 | 10.2 | 43.8 | 45,858 | 613 | 14.7 | 47.3 | 47,827 |

SOURCE: NIH, Office of Associate Director for Administration (1988)

TABLE 3-8, Continued SELECTED EMPLOYMENT DATA FOR CURRENT FULL-TIME PERMANENT NIH TENURED SCIENTISTS IN INTRAMURAL POSITIONS BY GRADE (SSS, GS/GM 13-15, CO 4-7) DATA AS OF SEPTEMBER 1984

| | M.D. | | | | Ph.D. | | | |
|---|---|---|---|---|---|---|---|---|
| PAYPLAN/ GRADE | CURRENT FTP STAFF | AVG YRS AT NIH | AVG AGE | AVG SALARY (INCL PCA) | CURRENT FTP STAFF | AVG YRS AT NIH | AVG AGE | AVG SALARY (INCL PCA) |
| SSS | 28 | 16.1 | 56.5 | 75,490 | 66 | 22.3 | 57.4 | 66,308 |
| SUBTOTAL | 28 | 16.1 | 56.5 | 75,490 | 66 | 22.3 | 57.4 | 66,308 |
| GS/GM-15 | 48 | 10.2 | 48.7 | 71,175 | 128 | 17.4 | 51.1 | 59,559 |
| GS/GM-14 | 40 | 9.1 | 43.8 | 63,480 | 166 | 14.0 | 46.7 | 49,914 |
| GS/GM-13 | 10 | 8.6 | 42.1 | 55,806 | 178 | 12.1 | 44.6 | 41,920 |
| SUBTOTAL | 98 | 9.6 | 46.0 | 66,466 | 472 | 14.2 | 47.1 | 49,515 |
| CO-7 | 2 | 33.0 | 60.0 | 56,854 | 0 | .0 | .0 | 0 |
| CO-6 | 160 | 13.3 | 46.7 | 44,973 | 42 | 18.6 | 49.5 | 46,715 |
| SUBTOTAL | 162 | 13.5 | 46.8 | 45,120 | 42 | 18.6 | 49.5 | 46,715 |
| CO-5 | 88 | 7.1 | 38.3 | 34,208 | 20 | 9.6 | 39.7 | 34,757 |
| CO-4 | 24 | 3.7 | 33.5 | 28,198 | 11 | 7.3 | 35.9 | 28,613 |
| SUBTOTAL | 112 | 6.4 | 37.3 | 32,920 | 31 | 8.8 | 38.3 | 32,577 |
| TOTAL | 400 | 10.7 | 44.6 | 49,060 | 611 | 15.1 | 47.9 | 50,277 |

SOURCE: NIH, Office of Associate Director for Administration (1988)

TABLE 3-8, Continued SELECTED EMPLOYMENT DATA FOR CURRENT FULL-TIME PERMANENT NIH TENURED SCIENTISTS IN INTRAMURAL POSITIONS BY GRADE (SSS, GS/GM 13-15, CO 4-7) DATA AS OF SEPTEMBER 1985

| | M.D. | | | | Ph.D. | | | |
|---|---|---|---|---|---|---|---|---|
| PAYPLAN/ GRADE | CURRENT FTP STAFF | AVG YRS AT NIH | AVG AGE | AVG SALARY (INCL PCA) | CURRENT FTP STAFF | AVG YRS AT NIH | AVG AGE | AVG SALARY (INCL PCA) |
| SSS | 27 | 16.5 | 56.1 | 77,635 | 64 | 23.0 | 57.6 | 68,640 |
| SUBTOTAL | 27 | 16.5 | 56.1 | 77,635 | 64 | 23.0 | 57.6 | 68,640 |
| GS/GM-15 | 51 | 11.1 | 48.9 | 74,939 | 135 | 16.9 | 51.0 | 62,192 |
| GS/GM-14 | 38 | 9.4 | 43.7 | 65,414 | 204 | 13.6 | 46.8 | 52,118 |
| GS/GM-13 | 11 | 7.9 | 39.1 | 55,947 | 201 | 11.5 | 44.6 | 43,505 |
| SUBTOTAL | 100 | 10.1 | 45.9 | 69,230 | 540 | 13.7 | 47.0 | 51,431 |
| CO-7 | 2 | 34.0 | 61.0 | 59,130 | 0 | .0 | .0 | 0 |
| CO-6 | 166 | 14.1 | 47.2 | 47,270 | 52 | 18.5 | 49.7 | 48,422 |
| SUBTOTAL | 168 | 14.4 | 47.4 | 47,411 | 52 | 18.5 | 49.7 | 48,422 |
| CO-5 | 86 | 7.2 | 38.6 | 35,442 | 20 | 9.6 | 41.3 | 36,580 |
| CO-4 | 20 | 3.8 | 34.4 | 29,968 | 14 | 6.2 | 35.9 | 29,497 |
| SUBTOTAL | 106 | 6.5 | 37.8 | 34,409 | 34 | 8.2 | 39.1 | 33,663 |
| TOTAL | 401 | 11.4 | 45.1 | 51,450 | 690 | 14.6 | 47.8 | 51,925 |

SOURCE: NIH, Office of Associate Director for Administration (1988)

TABLE 3-8, Continued SELECTED EMPLOYMENT DATA FOR CURRENT FULL-TIME PERMANENT NIH TENURED SCIENTISTS IN INTRAMURAL POSITIO GRADE (SSS, GS/GM 13-15, CO 4-7) DATA AS OF SEPTEMBER 1986

| | M.D. | | | | Ph.D. | | | |
|---|---|---|---|---|---|---|---|---|
| PAYPLAN/ GRADE | CURRENT FTP STAFF | AVG YRS AT NIH | AVG AGE | AVG SALARY (INCL PCA) | CURRENT FTP STAFF | AVG YRS AT NIH | AVG AGE | AVG SALARY (INCL PCA) |
| SES | 0 | .0 | .0 | 0 | 0 | .0 | .0 | 0 |
| SSS | 26 | 18.1 | 57.5 | 78,143 | 62 | 23.4 | 58.0 | 68,638 |
| SUBTOTAL | 26 | 18.1 | 57.5 | 78,143 | 62 | 23.4 | 58.0 | 68,638 |
| GS/GM-15 | 54 | 11.5 | 49.7 | 75,665 | 148 | 16.8 | 51.2 | 62,695 |
| GS/GM-14 | 41 | 9.0 | 43.0 | 65,791 | 197 | 14.0 | 47.4 | 52,463 |
| GS/GM-13 | 12 | 8.5 | 40.3 | 58,706 | 186 | 12.3 | 45.0 | 43,965 |
| SUBTOTAL | 107 | 10.2 | 46.1 | 69,980 | 531 | 14.2 | 47.6 | 52,338 |
| CO-7 | 3 | 27.0 | 58.6 | 73,460 | 0 | .0 | .0 | 0 |
| CO-6 | 180 | 14.7 | 47.5 | 68,968 | 47 | 18.8 | 50.3 | 63,188 |
| SUBTOTAL | 183 | 14.9 | 47.7 | 69,041 | 47 | 18.8 | 50.3 | 63,188 |
| CO-5 | 77 | 6.8 | 38.4 | 57,576 | 21 | 10.2 | 41.6 | 48,832 |
| CO-4 | 13 | 2.3 | 34.6 | 46,532 | 10 | 7.2 | 36.3 | 38,905 |
| SUBTOTAL | 90 | 6.2 | 37.9 | 55,981 | 31 | 9.2 | 39.9 | 45,629 |
| TOTAL | 406 | 11.9 | 45.7 | 69,976 | 671 | 15.1 | 48.4 | 54,294 |

SOURCE: NIH, Office of Associate Director for Administration (1988)

TABLE 3-8, Continued SELECTED EMPLOYMENT DATA FOR CURRENT FULL-TIME PERMANENT NIH TENURED SCIENTISTS IN INTRAMURAL POSITIO GRADE (SSS, GS/GM 13-15, CO 4-7) DATA AS OF SEPTEMBER 1987

| | M.D. | | | | Ph.D. | | | |
|---|---|---|---|---|---|---|---|---|
| PAYPLAN/ GRADE | CURRENT FTP STAFF | AVG YRS AT NIH | AVG AGE | AVG SALARY (INCL PCA) | CURRENT FTP STAFF | AVG YRS AT NIH | AVG AGE | AVG SALARY (INCL PCA) |
| SES | 0 | .0 | .0 | 0 | 0 | .0 | .0 | 0 |
| SSS | 24 | 19.1 | 58.4 | 82,883 | 61 | 24.1 | 58.7 | 73,326 |
| SUBTOTAL | 24 | 19.1 | 58.4 | 82,883 | 51 | 24.1 | 58.7 | 73,326 |
| GS/GM-15 | 54 | 12.3 | 49.2 | 78,963 | 156 | 16.3 | 50.6 | 64,884 |
| GS/GM-14 | 44 | 9.5 | 43.0 | 67,815 | 200 | 14.2 | 47.8 | 54,151 |
| GS/GM-13 | 14 | 7.8 | 39.9 | 58,241 | 188 | 12.3 | 45.4 | 45,449 |
| SUBTOTAL | 112 | 10.6 | 45.7 | 71,993 | 544 | 14.1 | 47.8 | 54,222 |
| CO-7 | 3 | 28.0 | 59.6 | 74,476 | 0 | .0 | .0 | 0 |
| CO-6 | 185 | 15.6 | 48.0 | 71,065 | 47 | 18.6 | 50.1 | 64,052 |
| SUBTOTAL | 188 | 15.8 | 48.2 | 71,120 | 47 | 18.6 | 50.1 | 64,052 |
| CO-5 | 66 | 7.0 | 39.3 | 59,043 | 20 | 10.2 | 41.8 | 50,332 |
| CO-4 | 16 | 1.8 | 34.6 | 44,840 | 9 | 4.4 | 34.3 | 39,503 |
| SUBTOTAL | 82 | 6.0 | 38.4 | 56,272 | 29 | 8.4 | 39.4 | 46,972 |
| TOTAL | 406 | 12.6 | 46.1 | 69,057 | 681 | 15.1 | 48.6 | 56,303 |

SOURCE: NIH, Office of Associate Director for Administration (1988)

TABLE 3-8, Continued SELECTED EMPLOYMENT DATA FOR CURRENT FULL-TIME PERMANENT NIH TENURED SCIENTISTS IN INTRAMURAL POSITIO GRADE (SSS, GS/GM 13-15, CO 4-7) DATA AS OF MAY 21, 1988

| | M.D. | | | | Ph.D. | | | |
|---|---|---|---|---|---|---|---|---|
| PAYPLAN/ GRADE | CURRENT FTP STAFF | AVG YRS AT NIH | AVG AGE | AVG SALARY (INCL PCA) | CURRENT FTP STAFF | AVG YRS AT NIH | AVG AGE | AVG SALARY (INCL PCA) |
| SSS | 25 | 19.4 | 58.4 | 88,733 | 58 | 24.7 | 59.0 | 73,395 |
| SUBTOTAL | 25 | 19.4 | 58.4 | 88,733 | 58 | 24.7 | 59.0 | 73,395 |
| GS/GM-15 | 51 | 12.3 | 49.2 | 83,746 | 157 | 17.0 | 50.8 | 66,877 |
| GS/GM-14 | 44 | 10.4 | 43.0 | 73,064 | 199 | 15.1 | 48.4 | 55,809 |
| GS/GM-13 | 16 | 7.8 | 40.2 | 62,480 | 189 | 12.0 | 44.9 | 46,564 |
| SUBTOTAL | 111 | 10.9 | 45.5 | 76,446 | 545 | 14.6 | 47.9 | 55,791 |
| CO-7 | 3 | 29.0 | 60.0 | 75,807 | 0 | .0 | .0 | 0 |
| CO-6 | 183 | 16.6 | 48.6 | 72,369 | 40 | 19.5 | 50.7 | 64,468 |
| SUBTOTAL | 186 | 16.8 | 48.8 | 72,424 | 40 | 19.5 | 50.7 | 64,468 |
| CO-5 | 63 | 7.7 | 39.6 | 60,338 | 19 | 10.8 | 42.0 | 52,020 |
| CO-4 | 17 | 2.7 | 35.3 | 47,356 | 13 | 2.9 | 37.3 | 42,010 |
| SUBTOTAL | 80 | 6.7 | 38.7 | 57,579 | 32 | 7.6 | 40.1 | 47,954 |
| TOTAL | 402 | 13.3 | 46.5 | 71,595 | 675 | 15.4 | 48.6 | 57,446 |

SOURCE: NIH, Office of Associate Director for Administration (1988)

TABLE 3-9 SELECTED EMPLOYMENT DATA FOR FULL-TIME PERMANENT NIH SENIOR SCIENTISTS WHO LEFT NIH INTRAMURAL POSITIONS BY GRADE (SSS, GS/GM 13-15, CO 4-7) FISCAL YEAR 1983

| | M.D. | | | Ph.D. | | |
|---|---|---|---|---|---|---|
| | UPON LEAVING NIH | | | UPON LEAVING NIH | | |
| PAYPLAN/ GRADE | AVG YRS AT NIH | AVG AGE | AVG SALARY (INCL PCA) | AVG YRS AT NIH | AVG AGE | AVG SALARY (INCL PCA) |
| SSS | 21.0 | 50.0 | 63,800 | 28.5 | 69.5 | 63,800 |
| SUBTOTAL | 21.0 | 50.0 | 63,800 | 28.5 | 69.5 | 63,800 |
| GS/GM-15 | 17.6 | 53.6 | 62,455 | 21.0 | 62.4 | 59,358 |
| GS/GM-14 | 7.3 | 39.0 | 51,596 | 17.0 | 46.7 | 44,784 |
| GS/GM-13 | 10.0 | 40.0 | 52,626 | 22.7 | 62.7 | 41,808 |
| SUBTOTAL | 12.1 | 45.4 | 56,397 | 20.7 | 58.6 | 48,036 |
| CO-7 | | | | | | |
| CO-6 | | 57.0 | | | 57.5 | |
| SUBTOTAL | | 57.0 | | | 57.5 | |
| CO-5 | | 42.9 | | 0 | | |
| CO-4 | | 37.0 | | | | |
| SUBTOTAL | | 38.3 | | 0 | | |
| TOTAL | | 40.4 | | | 59.6 | |

TABLE 3-9 SELECTED EMPLOYMENT DATA FOR FULL-TIME PERMANENT NIH SENIOR SCIENTISTS WHO LEFT NIH INTRAMURAL POSITIONS BY GRADE (SSS, GS/GM 13-15, CO 4-7) FISCAL YEAR 1984 (Continued)

| | M.D. | | | Ph.D. | | |
|---|---|---|---|---|---|---|
| | UPON LEAVING NIH | | | UPON LEAVING NIH | | |
| PAYPLAN/ GRADE | AVG YRS AT NIH | AVG AGE | AVG SALARY (INCL PCA) | AVG YRS AT NIH | AVG AGE | AVG SALARY (INCL PCA) |
| SSS | 21.5 | 73.5 | 63,800 | 20.5 | 66.0 | 66,200 |
| SUBTOTAL | 21.5 | 73.5 | 63,800 | 20.5 | 66.0 | 66,200 |
| GS/GM-15 | 12.0 | 53.5 | 64,991 | 14.0 | 48.6 | 59,239 |
| GS/GM-14 | 12.5 | 45.0 | 57,304 | 19.3 | 50.1 | 48,873 |
| GS/GM-13 | | | | 14.5 | 44.6 | 40,824 |
| SUBTOTAL | 12.1 | 50.6 | 62,429 | 16.7 | 47.9 | 47,861 |
| CO-7 | | | | | | |
| CO-6 | 6.2 | 55.0 | | 8.4 | 53.0 | |
| SUBTOTAL | 6.2 | 55.0 | | 8.4 | 53.0 | |
| CO-5 | 7.8 | 42.0 | | | | |
| CO-4 | 3.3 | 38.0 | | | 39.0 | |
| SUBTOTAL | 6.1 | 40.5 | | | 39.0 | |
| TOTAL | 8.2 | 48.0 | | 14.6 | 50.0 | |

TABLE 3-9 SELECTED EMPLOYMENT DATA FOR FULL-TIME PERMANENT NIH SENIOR SCIENTISTS WHO LEFT NIH INTRAMURAL POSITIONS BY GRADE (SSS, GS/GM 13-15, CO 4-7) FISCAL YEAR 1985 (Continued)

| | M.D. | | | Ph.D. | | |
|---|---|---|---|---|---|---|
| | UPON LEAVING NIH | | | UPON LEAVING NIH | | |
| PAYPLAN/ GRADE | AVG YRS AT NIH | AVG AGE | AVG SALARY (INCL PCA) | AVG YRS AT NIH | AVG AGE | AVG SALARY (INCL PCA) |
| SSS | 20.6 | 59.6 | 67,933 | 24.0 | 67.6 | 67,933 |
| SUBTOTAL | 20.6 | 59.6 | 67,933 | 24.0 | 67.6 | 67,933 |
| GS/GM-15 | 11.0 | 53.0 | 66,393 | 22.7 | 57.5 | 62,904 |
| GS/GM-14 | 6.2 | 40.4 | 55,284 | 21.1 | 56.8 | 53,102 |
| GS/GM-13 | 9.5 | 52.0 | 48,481 | 18.5 | 50.0 | 44,174 |
| SUBTOTAL | 8.2 | 46.0 | 57,656 | 21.0 | 55.1 | 54,813 |
| CO-7 | | | | | | |
| CO-6 | 15.3 | 50.8 | | | | |
| SUBTOTAL | 15.3 | 50.8 | | | | |
| CO-5 | 10.4 | 41.1 | | 9.0 | 41.0 | |
| CO-4 | 4.0 | 41.0 | | | | |
| SUBTOTAL | 9.9 | 41.1 | | 9.0 | 41.0 | |
| TOTAL | 11.3 | 46.4 | | 20.5 | 55.4 | |

TABLE 3-9 SELECTED EMPLOYMENT DATA FOR FULL-TIME PERMANENT NIH SENIOR SCIENTISTS WHO LEFT NIH INTRAMURAL POSITIONS BY GRADE (SSS, GS/GM 13-15, CO 4-7) FISCAL YEAR 1986 (Continued)

| | M.D. | | | Ph.D. | | |
|---|---|---|---|---|---|---|
| | UPON LEAVING NIH | | | UPON LEAVING NIH | | |
| PAYPLAN/ GRADE | AVG YRS AT NIH | AVG AGE | AVG SALARY (INCL PCA) | AVG YRS AT NIH | AVG AGE | AVG SALARY (INCL PCA) |
| SSS | 12.0 | 50.5 | 68,700 | 35.6 | 68.6 | 68,700 |
| SUBTOTAL | 12.0 | 50.5 | 68,700 | 35.6 | 68.6 | 68,700 |
| GS/GM-15 | 8.0 | 39.7 | 63,995 | 22.6 | 54.1 | 63,893 |
| GS/GM-14 | 34.0 | 71.0 | 63,530 | 16.5 | 49.7 | 52,926 |
| GS/GM-13 | 4.0 | 32.0 | 45,398 | 13.4 | 48.3 | 44,044 |
| SUBTOTAL | 11.6 | 43.6 | 60,818 | 16.7 | 50.1 | 52,041 |
| CO-7 | | | | | | |
| CO-6 | 17.2 | 49.7 | | 31.0 | 61.6 | |
| SUBTOTAL | 17.2 | 49.7 | | 31.0 | 61.6 | |
| CO-5 | 8.4 | 39.6 | | 19.0 | 43.0 | |
| CO-4 | 7.6 | 35.3 | | 8.0 | 34.5 | |
| SUBTOTAL | 8.1 | 38.0 | | 11.6 | 37.3 | |
| TOTAL | 11.4 | 43.3 | | 19.1 | 51.6 | |

TABLE 3-9 SELECTED EMPLOYMENT DATA FOR FULL-TIME PERMANENT NIH SENIOR SCIENTISTS WHO LEFT NIH INTRAMURAL POSITIONS BY GRADE (SSS, GS/GM 13-15, CO 4-7) FISCAL YEAR 1987

| | M.D. | | | Ph.D. | | |
|---|---|---|---|---|---|---|
| | UPON LEAVING NIH | | | UPON LEAVING NIH | | |
| PAYPLAN/ GRADE | AVG YRS AT NIH | AVG AGE | AVG SALARY (INCL PCA) | AVG YRS AT NIH | AVG AGE | AVG SALARY (INCL PCA) |
| SSS | 12.5 | 52.0 | 73,400 | 35.0 | 67.3 | 71,833 |
| SUBTOTAL | 12.5 | 52.0 | 73,400 | 35.0 | 67.3 | 71,833 |
| GS/GM-15 | 14.5 | 60.0 | 69,813 | 22.4 | 56.7 | 65,543 |
| GS/GM-14 | 6.0 | 37.0 | 57,715 | 19.6 | 53.6 | 55,130 |
| GS/GM-13 | 3.0 | 39.0 | 58,037 | 11.7 | 43.3 | 44,266 |
| SUBTOTAL | 8.3 | 44.2 | 61,462 | 17.9 | 51.1 | 55,384 |
| CO-7 | | | | | | |
| CO-6 | 12.5 | 49.2 | | 22.0 | 57.6 | |
| SUBTOTAL | 12.5 | 49.2 | | 22.0 | 57.6 | |
| CO-5 | 11.0 | 39.0 | | | | |
| CO-4 | 4.2 | 37.2 | | | | |
| SUBTOTAL | 6.5 | 37.8 | | | | |
| TOTAL | 9.3 | 44.6 | | 19.9 | 53.3 | |

TABLE 3-10 ATTRITION OF NIH FULL-TIME PERMANENT TENURED SCIENTISTS (M.D.s AND Ph.D.s) IN INTRAMURAL POSITIONS BY GRADE (SSS, GS/GM 13-15, CO 4-7) FISCAL YEAR 1983

| | M.D. | | | Ph.D. | | |
|---|---|---|---|---|---|---|
| PAYPLAN/ GRADE | STAFF START OF FY | NO. LEFT NIH | LOSS RATE | STAFF START OF FY | NO. LEFT NIH | LOSS RATE |
| SSS | 29 | 1 | 3.4% | 63 | 2 | 3.2% |
| SUBTOTAL | 29 | 1 | 3.4% | 63 | 2 | 3.2% |
| GS/GM-15 | 50 | 3 | 6.0% | 115 | 5 | 4.3% |
| GS/GM-14 | 36 | 3 | 8.3% | 167 | 4 | 2.4% |
| GS/GM-13 | 10 | 1 | 10.0% | 184 | 7 | 3.8% |
| SUBTOTAL | 96 | 7 | 7.3% | 466 | 16 | 3.4% |
| CO-7 | 2 | 0 | 0.0% | 0 | 0 | |
| CO-6 | 130 | 4 | 3.1% | 44 | 2 | 4.5% |
| SUBTOTAL | 132 | 4 | 3.0% | 44 | 2 | 4.5% |
| CO-5 | 116 | 11 | 9.5% | 26 | 0 | 0.0% |
| CO-4 | 74 | 40 | 54.1% | 10 | 0 | 0.0% |
| SUBTOTAL | 190 | 51 | 26.8% | 36 | 0 | 0.0% |
| TOTAL | 447 | 63 | 14.1% | 609 | 20 | 3.3% |

SOURCE: NIH, Office of Associate Director for Administration (1988)

TABLE 3-10, Continued ATTRITION OF NIH FULL-TIME PERMANENT TENURED SCIENTISTS (M.D.s AND Ph.D.s) IN INTRAMURAL POSITIONS BY GRADE (SSS, GS/GM 13-15, CO 4-7) FISCAL YEAR 1984

| | M.D. | | | Ph.D. | | |
|---|---|---|---|---|---|---|
| PAYPLAN/ GRADE | STAFF START OF FY | NO. LEFT NIH | LOSS RATE | STAFF START OF FY | NO. LEFT NIH | LOSS RATE |
| SSS | 25 | 0 | 0.0% | 62 | 1 | 1.6% |
| SUBTOTAL | 25 | 0 | 0.0% | 62 | 1 | 1.6% |
| GS/GM-15 | 49 | 4 | 8.2% | 118 | 3 | 2.5% |
| GS/GM-14 | 38 | 2 | 5.3% | 172 | 8 | 4.7% |
| GS/GM-13 | 8 | 0 | 0.0% | 178 | 6 | 3.4% |
| SUBTOTAL | 95 | 6 | 6.3% | 468 | 17 | 3.6% |
| CO-7 | 2 | 0 | 0.0% | 0 | 0 | 0.0% |
| CO-6 | 152 | 8 | 5.3% | 44 | 5 | 11.4% |
| SUBTOTAL | 154 | 8 | 5.2% | 44 | 5 | 11.4% |
| CO-5 | 103 | 10 | 9.7% | 23 | 0 | 0.0% |
| CO-4 | 36 | 6 | 16.7% | 12 | 1 | 8.3% |
| SUBTOTAL | 139 | 16 | 11.5% | 35 | 1 | 2.9% |
| TOTAL | 413 | 30 | 7.3% | 609 | 24 | 3.9% |

SOURCE: NIH, Office of Associate Director for Administration (1988)

TABLE 3-10, Continued ATTRITION OF NIH FULL-TIME PERMANENT TENURED SCIENTISTS (M.D.s AND Ph.D.s) IN INTRAMURAL POSITIONS BY GRADE (SSS, GS/GM 13-15, CO 4-7) FISCAL YEAR 1985

| PAYPLAN/ GRADE | M.D. STAFF START OF FY | M.D. NO. LEFT NIH | M.D. LOSS RATE | Ph.D. STAFF START OF FY | Ph.D. NO. LEFT NIH | Ph.D. LOSS RATE |
|---|---|---|---|---|---|---|
| SSS | 26 | 2 | 7.7% | 61 | 2 | 3.3% |
| SUBTOTAL | 26 | 2 | 7.7% | 61 | 2 | 3.3% |
| GS/GM-15 | 48 | 4 | 8.3% | 128 | 12 | 9.4% |
| GS/GM-14 | 40 | 7 | 17.5% | 166 | 7 | 4.2% |
| GS/GM-13 | 10 | 2 | 20.0% | 178 | 8 | 4.5% |
| SUBTOTAL | 98 | 13 | 13.3% | 472 | 27 | 5.7% |
| CO-7 | 2 | 0 | 0.0% | 0 | 0 | 0.0% |
| CO-6 | 160 | 8 | 5.0% | 42 | 0 | 0.0% |
| SUBTOTAL | 162 | 8 | 4.9% | 42 | 0 | 0.0% |
| CO-5 | 88 | 12 | 13.6% | 20 | 2 | 10.0% |
| CO-4 | 24 | 1 | 4.2% | 11 | 0 | 0.0% |
| SUBTOTAL | 112 | 13 | 11.6% | 31 | 2 | 6.5% |
| TOTAL | 398 | 36 | 9.0% | 606 | 31 | 5.1% |

SOURCE: NIH, Office of Associate Director for Administration (1988)

TABLE 3-10, Continued ATTRITION OF NIH FULL-TIME PERMANENT TENURED SCIENTISTS (M.D.s AND Ph.D.s) IN INTRAMURAL POSITIONS BY GRADE (SSS, GS/GM 13-15, CO 4-7) FISCAL YEAR 1986

| | M.D. | | | Ph.D. | | |
|---|---|---|---|---|---|---|
| PAYPLAN/ GRADE | STAFF START OF FY | NO. LEFT NIH | LOSS RATE | STAFF START OF FY | NO. LEFT NIH | LOSS RATE |
| SSS | 22 | 1 | 4.5% | 63 | 2 | 3.2% |
| SUBTOTAL | 22 | 1 | 4.5% | 63 | 2 | 3.2% |
| GS/GM-15 | 51 | 4 | 7.8% | 135 | 6 | 4.4% |
| GS/GM-14 | 38 | 1 | 2.6% | 204 | 10 | 4.9% |
| GS/GM-13 | 11 | 1 | 9.1% | 201 | 10 | 5.0% |
| SUBTOTAL | 100 | 6 | 6.0% | 540 | 26 | 4.8% |
| CO-7 | 2 | 0 | 0.0% | 0 | 0 | 0.0% |
| CO-6 | 166 | 4 | 2.4% | 52 | 3 | 5.8% |
| SUBTOTAL | 168 | 4 | 2.4% | 52 | 3 | 5.8% |
| CO-5 | 86 | 5 | 5.8% | 20 | 1 | 5.0% |
| CO-4 | 20 | 3 | 15.0% | 14 | 2 | 14.3% |
| SUBTOTAL | 106 | 8 | 7.5% | 34 | 3 | 8.8% |
| TOTAL | 396 | 19 | 4.8% | 689 | 34 | 4.9% |

SOURCE: NIH, Office of Associate Director for Administration (1988)

TABLE 3-10, Continued ATTRITION OF NIH FULL-TIME PERMANENT TENURED SCIENTISTS (M.D.s AND Ph.D.s) IN INTRAMURAL POSITIONS BY GRADE (SSS, GS/GM 13-15, CO 4-7) FISCAL YEAR 1987

| | M.D. | | | Ph.D. | | |
|---|---|---|---|---|---|---|
| PAYPLAN/ GRADE | STAFF START OF FY | NO. LEFT NIH | LOSS RATE | STAFF START OF FY | NO. LEFT NIH | LOSS RATE |
| SSS | 21 | 1 | 4.8% | 60 | 3 | 5.0% |
| SUBTOTAL | 21 | 1 | 4.8% | 60 | 3 | 5.0% |
| GS/GM-15 | 54 | 4 | 7.4% | 148 | 10 | 6.8% |
| GS/GM-14 | 41 | 8 | 19.5% | 197 | 6 | 3.0% |
| GS/GM-13 | 12 | 1 | 8.3% | 186 | 9 | 4.8% |
| SUBTOTAL | 107 | 13 | 12.1% | 531 | 25 | 4.7% |
| CO-7 | 3 | 0 | 0.0% | 0 | 0 | 0.0% |
| CO-6 | 180 | 7 | 3.9% | 47 | 3 | 6.4% |
| SUBTOTAL | 183 | 7 | 3.8% | 47 | 3 | 6.4% |
| CO-5 | 77 | 2 | 2.6% | 21 | 0 | 0.0% |
| CO-4 | 13 | 4 | 30.8% | 10 | 0 | 0.0% |
| SUBTOTAL | 90 | 6 | 6.7% | 31 | 0 | 0.0% |
| TOTAL | 401 | 27 | 6.7% | 669 | 31 | 4.6% |

SOURCE: NIH, Office of Associate Director for Administration (1988)

TABLE 3-11 APPOINTMENTS OF SCIENTISTS TO NIH INTRAMURAL POSITIONS BY GRADE AND DEGREE
Fiscal Years 1983 - 1987

| FY/Grade | | M.D. | Ph.D. | Type of Doc Unknown | Total |
|---|---|---|---|---|---|
| 1983 | SSS | 0 | 0 | 0 | 0 |
| | GS/GM 13-15 | 4 | 2 | 0 | 6 |
| | CO 4-6 | 1 | 0 | 5 | 6 |
| | Total | 5 | 2 | 5 | 12 |
| 1984 | SSS | 0 | 0 | 0 | 0 |
| | GS/GM 13-15 | 4 | 6 | 0 | 10 |
| | CO 4-6 | 4 | 1 | 2 | 7 |
| | Total | 8 | 7 | 2 | 17 |
| 1985 | SSS | 0 | 0 | 0 | 0 |
| | GS/GM 13-15 | 7 | 2 | 0 | 9 |
| | CO 4-6 | 3 | 1 | 0 | 4 |
| | Total | 10 | 3 | 0 | 13 |
| 1986 | SSS | 0 | 0 | 0 | 0 |
| | GS/GM 13-15 | 7 | 3 | 0 | 10 |
| | CO 4-6 | 2 | 1 | 0 | 3 |
| | Total | 9 | 4 | 0 | 13 |
| 1987 | SSS | 0 | 0 | 0 | 0 |
| | GS/GM 13-15 | 7 | 9 | 0 | 16 |
| | CO 4-6 | 2 | 0 | 0 | 2 |
| | Total | 9 | 9 | 0 | 18 |
| 1983 - 1987 | | | | | |
| | SSS | 0 | 0 | 0 | 0 |
| | GS/GM 13-15 | 29 | 22 | 0 | 51 |
| | CO 4-6 | 12 | 3 | 7 | 22 |
| | TOTAL | 41 | 25 | 7 | 73 |

SOURCE: NIH, Office of Associate Director for Administration (1988)

Table 3-12 APPOINTMENT OF SCIENTISTS TO NIH INTRAMURAL PROGRAMS DISTRIBUTION BY GRADE. 1983-1987

| GRADE | M.D. | Ph.D. | TYPE OF DOC UNKNOWN | TOTAL |
|---|---|---|---|---|
| GS/GM | | | | |
| 15 | 11 | 11 | 0 | 22 |
| 14 | 13 | 6 | 0 | 19 |
| 13 | 5 | 5 | 0 | 10 |
| SUBTOTAL | 29 | 22 | 0 | 51 |
| CO | | | | |
| 6 | 1 | 1 | 3 | 5 |
| 5 | 2 | 0 | 3 | 5 |
| 4 | 9 | 2 | 1 | 12 |
| SUBTOTAL | 12 | 3 | 7 | 22 |
| TOTAL | 41 | 25 | 7 | 73 |

SOURCE: NIH, Office of Associate Director for Administration (1988)

TABLE 3-13 COMPARATIVE SALARIES OF RESEARCH SCIENTISTS (in thousands)

| RANK | NIH | USUHS | AAMC MD Clinical Science Depts base salary only | AAMC MD Internal Medicine base salary only | AAMC MD Internal Medicine base salary only (80 Percentile) | AAMC MD Pediatrics base salary only | AAMC Ph.D-Basic Science Depts | Private Research Institutes 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GS-13/ Assistant Professor (MD) | 62 | 64 | 83 | 79 | | 60 | | 38/50 | | 32 | | 42 | 30 | | |
| GS-13/ Assistant Professor (PhD) | 47 | 37 | | | | | 38 | 38/50 | 35/56 | 48 | 25/35 | 70 | 45 | | |
| GS-14/ Associate Professor (MD) | 73 | 76 | 99 | 93 | | 76 | | 53/85 | | 42 | | 52 | 40 | 35 | |
| GS-14/ Associate Professor (PhD) | 56 | 48 | | | | | 49 | 53/85 | 47/78 | 70 | 35/50 | 100 | 55 | 50 | |
| GS-15/ Professor (MD) | 84 | 90 | 117 | 111 | 128 | 98 | | 66/155 | | 68 | | 75/up | 50 | 45 | |
| GS-15/ Professor (PhD) | 67 | 69 | | | | | 66 | 66/155 | 58/96 | 97 | 45/60 | 75/up | 65 | 65 | |
| SSS/ Department Chair (MD) | 89 | 112 | 153 | 170 | | 145 | | | | 100/up | | | | 60 | |
| SSS/ Department Chair (PhD) | 74 | 98 | | | | | 87 | | | | 60/up | | | 85 | |

NOTE: USUHS is the Uniformed Services University of the Health Sciences.
AAMC is the Association of American Medical Colleges.
For NIH data for Ph.D.s compensation is base salary only, for M.D.s Compensation is base salary plus supplements.
AAMC data is from annual report on medical school faculty salaries 1987-1988. Base only refers to compensation that is fixed by the institution, is exclusive of fringe benefits and is normally not influenced by practice earnings.

TABLE 3-14 Change in Average Annual Salaries Reported by Doctorates at NIH in 1981 by Type of Employer in 1987

| | n | N | Average 1987 Salary | Average Change in Salary, 1981-1987 |
|---|---|---|---|---|
| Employees of NIH in 1981 and 1987 | 53 | 564 | $54,500 | $15,600 |
| Employees of NIH in 1981, but not in 1987, by 1987 employer: | | | | |
| Business/industry | 6 | 46 | $60,700 | $26,900 |
| University, Medical school | 5 | 37 | $74,300 | $35,900 |
| All other | 11 | 108 | $55,800 | $18,400 |
| Total | 22 | 191 | $60,564 | $23,837 |

NOTE: Analysis restricted to full-time employees less than 62 years of age. Doctorates equate to Ph.D.s in other tables.

SOURCE: National Science Foundation, Special Tabulation from the Survey of Doctorate Recipients (1988)

TABLE 3-15 Comparison of Physician Compensation* - NIH and American Medical Schools
(Mean NIH Compensation as a Percent of Mean AAMC Compensation)

| | GS-13 | GS-14 | GS-15 | SES/SSS |
|---|---|---|---|---|
| 1983 | 79 % | 76 % | 74 % | 60 % |
| 1988 | 69 % | 67 % | 65 % | 50 % |
| Percent Decrease | 10 % | 9 % | 9 % | 10 % |

* Compensation = Base Salary Plus Supplements

Clinical Science Departments

GS-13 = Assistant Professor

GS-14 = Associate Professor

GS-15 = Professor

SES/SSS = Chairmen

Data from Report on Medical School Faculty Salaries prepared by the Association of American Medical Colleges - 1983 through 1988

SOURCE: NIH, Office of Associate Director for Administration (1988)

TABLE 3-16 Comparison of Ph.D. Pay* - NIH and American Medical Schools
(Mean NIH Compensation as a Percent of Mean AAMC Compensation)

| | GS-13 | GS-14 | GS-15 | SES/SSS |
|---|---|---|---|---|
| 1983 | 133 % | 126 % | 116 % | 100 % |
| 1988 | 121 % | 115 % | 102 % | 83 % |
| Percent Decrease | 12 % | 11 % | 14 % | 17 % |

* Pay = Base Salary Only

Basic Science Departments

GS-13 = Assistant Professor

GS-14 = Associate Professor

GS-15 = Professor

SES/SSS = Chairmen

Data from Report on Medical School Faculty Salaries prepared by the Association of American Medical Colleges - 1983 through 1988

SOURCE: NIH, Office of Associate Director for Administration (1988)

TABLE 3-17 Allied Health Specialists Salary Comparison--Washington, D.C. Area January 1988

| OCCUPATION | SALARY[1] LEADER | NIH MAX HIRE SALARY | DOLLARS[2] DIFF. FROM SALARY LEADER | PERCENTAGE DIFF. FROM SALARY LEADER | RANK AMONG SURVEYED HOSPITALS |
|---|---|---|---|---|---|
| Nuclear Medicine Tech. | Georgetown | $20,739 | -$7,415 | -26% | 7 of 7 |
| Staff X-Ray Tech. | Georgetown | $18,726 | -$7,299 | -28% | 6 of 6 |
| Ultrasound Tech. | Georgetown | $20,739 | -$7,415 | -26% | 6 of 6 |
| Spec. Proc. X-Ray Tech. | Georgetown | $20,739 | -$7,415 | -26% | 6 of 6 |
| Reg. Respiratory Therapist | Wash.Hosp.Ctr | $20,223 | -$6,825 | -25% | 6 of 6 |
| Pharmacist | Wash.Hosp.Ctr. | $30,804 | -$7,597 | -20% | 6 of 7 |
| Physical Therapist | Suburban | $22,907 | -$8,148 | -26% | 7 of 7 |
| Occupational Therapist | Suburban | $22,907 | -$8,148 | -26% | 7 of 7 |
| Phlebotomist[3] | Suburban | $15,118 | -$1,891 | -11% | 4 of 7 |
| Medical Technologist[3] | Holy Cross | $22,907 | -$3,306 | -13% | 5 of 7 |

NOTES: 1. The following Washington, D.C. area hospitals are included in this survey (not all hospitals reported on all occupations):

| | |
|---|---|
| Fairfax Hospital | George Washington Univ. Medical Center |
| Georgetown Univ. Hospital | Greater Southeast Community Hospital |
| Holy Cross Hospital | Howard Univ. Hospital |
| Suburban Hospital | Washington Hospital Center |

2. Salary data is based upon July and November 1987, Confidential Wage and Salary Survey Reports, Hospital Council, National Capital Area.

3. Phlebotomist and Medical Technologist staffing difficulties are relatively recent compared to other occupations but appear to be increasing rapidly.

SOURCE: NIH, Office of Associate Director for Administration (1988)

# CHAPTER 4

# SOLVING ADMINISTRATIVE PROBLEMS

As part of its mandate for this study, the Institute of Medicine (IOM) was asked to review a broad spectrum of organizational strategies that might help alleviate problems the National Institutes of Health (NIH) was experiencing in recruiting and retaining scientists. In Chapter 3, the committee evaluated the nature and magnitude of these problems. This chapter begins with an exploration of a variety of organizational models to assess whether reorganization would provide an expeditious and comprehensive solution to problems, and, if so, whether possible new problems introduced by structural change might outweigh the benefits. Remedies that do not entail structural change are also examined. The chapter concludes with recommendations, which the committee believes are feasible to implement—both from a political and a logistical standpoint.

Several of the organizational reforms reviewed by the committee could be classed under the general heading of privatization. In a general sense, privatization refers to the transfer of some activity from the public to the private sector. There are many different ways such a transfer could take place, and it need not involve any reduction of government financial commitments to the activity involved. Indeed, the committee analysis of privatization focused on it as a means of revitalizing the program, rather than diminishing government responsibility and expenditures for biomedical research.

Every nation decides for itself which activities are most effectively pursued in the private sector, which are pursued in the public sector, and which should be pursued jointly. A review of contemporary arrangements in modern industrial nations reveals that, although there is a marked trend toward greater reliance on private markets, various nations have made quite different decisions in this respect. Even among the Organization for Economic Cooperation and Development (OECD) countries, there are very marked differences in the nature and importance of activities assigned to the public sector.

It is important not to confuse the scope of public sector activities with the scope of government responsibility—financial or otherwise. A government can easily retain financial responsibility for certain activities, but arrange for these activities to be carried out in the private sector. This can be accomplished, for example, by the issuance of vouchers or by contracting out. Government regulation of private sector activities is another mechanism through which the scope of government responsibility extends beyond the scope of public sector activity. User fees (e.g., highway tolls, drilling rights), on the other hand, represent a mechanism whereby private markets are used to put constraints on activities being carried out in the public sector. Thus, privatization encompasses large numbers of possible decisions regarding how a society will choose the appropriate vehicles to serve its interest at a particular time.

Whatever the word privatization means in the context of the NIH intramural program, it has galvanized interest in the nature of the program, its accomplishments under existing arrangements, and the challenge it faces in defining its future role, maintaining its excellence, or both. Reactions to the proposal have been strong and have ranged from incredulity and bemusement, to fear, and to thoughtful analysis of future options. The strength of the reaction and the stridency of some of the rhetoric indicate an appreciation for the achievements of the intramural program and a determination to preserve this element of the nation's biomedical research.

The committee found some forms of privatization clearly inappropriate for the intramural program because, given the nature of its product, it cannot generate adequate revenues through user fees or the sale of services to individuals. Nor does NIH have physical assets that anyone in the for-profit sector would be likely to buy and maintain as a basic biomedical research program. Other forms of privatization were in the realm of feasibility and worth considering as options. They are discussed in this chapter.

## THE POLICY BACKGROUND

In recent years, a large number of agencies have encountered difficulties in carrying out their programs within the context of laws, budgetary practices, personnel systems, procurement regulations, and departmental restraints. Among the organizations that have found the prevailing statutory and regulatory controls most confining are those engaged in scientific, technical, and research programs. Most of the laws and regulations relating to the administration of federal agencies were originally designed to foster efficiency, accountability, integrity, consistency, and equity among employees. Their cumulative effect, however, according to a study by the National Academy of Public Administration (NAPA), has been to impede innovative management and to drive up the cost of government, centralized systems and controls were found to jeopardize the effective execution of basic programs and to frustrate the best efforts of professional managers and employees (NAPA, 1983).

It might be desirable to resolve government-wide needs with across-the-board solutions, but individual agencies unable to wait for help through such general reforms have often sought relief through measures applicable only to themselves.

Since World War II, Congress, as well as the Executive Branch, have believed that some unique or strongly supported program should be freed from various constraints that apply to traditional agencies. Generally, agencies have been successful in securing enhanced discretion in administrative matters only when Congress is convinced that circumstances warrant their receiving treatment denied other agencies or programs.

Very recently, serious consideration has been given to improving the structure and administrative setting for such federal activities as air traffic control, uranium enrichment, technical information services, the national space effort, and the Tennessee Valley Authority programs. Legislation dealing with several of these activities is pending in Congress. With this active reconsideration of government functions and organizational reform, it is not surprising that biomedical research, and NIH in particular, has been subject to speculation.

The committee explored a variety of organizational forms to determine whether they would provide the flexibility needed to overcome the problems identified in the previous chapter. The results of the committee's inquiry, aided by NAPA, are summarized in the following sections (Dean and Seidman, 1988). The chapter later proceeds to a discussion of measures to solve discrete administrative problems, citing cases in which agencies have been authorized to adopt these remedies.

## MODELS FOR ORGANIZATIONAL REFORM

### An Independent Agency

It has been suggested that the intramural research program, or alternatively the whole of NIH, be reorganized as an independent agency on the model of the National Science Foundation (NSF). Establishment of independent agencies is often advocated by powerful, well organized constituency groups to (1) enhance program status and visibility, (2) improve the position of programs in the competition for financial and other resources, (3) facilitate access to key decision makers in the Executive Branch and the Congress, (4) protect the agency's resources from claims by other agencies within the department, and (5) maximize responsiveness to constituency interests.

In addition, the director of an independent agency is likely to have Executive Level II status. Because the Director of NIH is the head of an agency in the U.S. Public Health Service (PHS), his position cannot exceed Executive Level IV. Therefore, it is now difficult to accord the Director of NIH the necessary authority and status needed to act effectively as the key spokesperson for biomedical research interests worldwide. Finding ways to enhance the influence of the person who sits atop the $6 billion NIH enterprise is severely limited as long as NIH remains an agency within the Department of Health and Human Services (DHHS).

The committee considered two ways independent agency status might be conferred upon NIH: separating the whole of the agency from DHHS; or separating only the intramural program, leaving the other NIH activities in DHHS.

A recommendation to remove NIH completely from DHHS would necessitate a thorough examination of the advantages and disadvantages of such an action for all parts of NIH and DHHS itself. This was beyond the committee's charge, but even a cursory exploration of this option suggests some serious negative consequences that might override the benefits described above.

An agency that has a pure research mission, and is also seen as providing social benefits, is likely to find a more generous Congress. NIH leadership has skillfully capitalized on the connection between biomedical research and the conquest of disease. This identification is reinforced by its location in the PHS and DHHS. The committee cannot be certain that separation of NIH would damage its ability to maintain this identification. However, science agencies, whose chief constituency is the science community have a more difficult task in trying to convince lawmakers and the public of the relationship of their basic research to social benefit. They have not had the extraordinary and prolonged budgetary success of NIH (Lambright, 1976; Dean and Seidman, 1988). The committee believes an action that can jeopardize the support that has sustained the NIH budget can only be justified if a good case can be made for the existence of a crisis or the overwhelming advantages of change. The committee's investigation, which was limited by its charge, found that neither of these conditions exist. As the previous chapter indicates, the problems that need to be addressed are serious but not of crisis proportions. Moreover, independent agency status would not inherently solve the specific problems.

There is no reason to believe that the intramural program, as an independent agency, would be accorded greater flexibility in hiring and compensating personnel and conducting its operations than under the current structure. NSF furnishes an example. A recent position paper prepared by the NSF Division of Personnel Management complains of the growing problem in attracting high caliber scientists and engineers both for rotational positions (temporary personnel on leave from the private sector) and permanent staff. Non-competitive salary was one of the chief reasons cited for recruitment and retention problems. NSF also faces limitations in being able to pay non-salary elements, such as retirement. It is also facing new restrictions imposed by Congress in salary limitations for IPA's (employees on loan from institutions outside the government through the Intergovernmental Personnel Act); and on arrangements where industry shares the cost of personnel on loan to NSF (NSF, 1988).

As now structured, NIH enjoys higher status and visibility, greater freedom in hiring and setting the conditions of work and compensation of its employees, and more generous budgetary support than the independent NSF. In addition, some would argue that there is value in being part of a department that has a voice in the President's cabinet, a type of access independent agencies do not have. The idea of constituting the intramural research program on its own as an independent agency could pose a number of practical problems. It would require duplicating the administrative functions it now shares with the extramural program. It would be a more visible competitor for funds with the non-federal health research community. Finally, aside from the benefits lost from having the intramural and extramural programs exist side by side, a considerable effort would be required to extract intramural activities from institutes such as the National Cancer Institute (NCI), where the two programs are tightly integrated.

In sum, the committee could examine the effects of organizational change only on the intramural program, not on NIH as a whole, or the complete set of implications of withdrawing NIH from DHHS. It may well be that a study with a broader scope would conclude that forming NIH as an independent agency would be beneficial. But, given the potential of unexplored risks, and the existence of similar personnel problems at NIH and NSF, the committee did not think the change was worth the risk if there are less radical options available.

## A Federally-supported, Contractor-operated Research Center

The Departments of Energy, Defense, and Health and Human Services, the National Aeronautics and Space Administration, and the National Science Foundation, currently sponsor approximately 35 federally funded research and development centers (FFRDCs). Federal funding of such centers exceeds $4 billion a year. FFRDCs have been used to (1) conduct applied research or experimental tasks; (2) furnish systems engineering and technical management services; (3) provide operations research and analytical services; and (4) conduct social research and demonstrations. FFRDCs are rarely utilized to conduct pure research, and most of their tasks are done at the request of the sponsoring agency.

FFRDCs may be managed and operated by independent, nonprofit corporations such as the Rand and Aerospace corporations, which were organized at the instigation of the sponsoring agencies; or by universities, consortia of universities; or by industrial firms under so-called GOCO contracts (government-owned contractor-operated).

The Office of Federal Procurement Policy has issued regulations governing the use of FFRDCs, which provide among other things:

- that the sponsoring agency requests the research and monitors results.
- that the primary government sponsor must approve any work done for a government agency other than the sponsoring agency.
- that the primary sponsor undertakes the responsibility to assure reasonable continuity in level of support.
- that the center conducts its business in a responsible manner befitting its special relationship to the government, to operate in the public interest free from

- ○ organizational conflict of interest, and to disclose its affairs to the primary sponsor (Office of Federal Procurement Policy/1984).

Many research centers have established an environment to attract competent scientists. They have designed personnel and administrative systems that are better adapted to their missions than those generally applicable to federal agencies and employees. Nonetheless, with the exception of principal officers, most salaries are roughly equivalent to those provided by the current civil service salary structure. A recent NAPA study indicated the following salary ranges: program directors, $65,000 to $80,000; senior staff, $50,000 to $75,000; and research staff, $35,000 to $55,000 (Dean and Seidman, 1988). FFRDCs recognize that if they depart too much from the civil service pay structure, they run the risk of having pay limitations imposed either by the sponsoring agency, the Office of Management and Budget (OMB), or the Congress. Flexibility must be employed with discretion and not abused.

As an FFRDC, NIH would have to engage primarily in directed research. All FFRDC contracts specify some funds or some percentage of effort that may be utilized for self-initiated research, but this generally constitutes less than 20 percent of the total program. DHHS would need to maintain a strong internal capability to direct and monitor the research program. The division of responsibility between the contracting agency and the center, and between governmental employees and contract employees, would likely cause frictions and result in serious conflicts. Use of the FFRDC mechanism could reduce DHHS's ability to shift program direction and to utilize effectively its available personnel resources. Center employees are not federal employees and, consequently, cannot be shifted to other tasks within NIH. Flexibility in conducting the intramural research programs might be obtained at the cost of loss of flexibility elsewhere.

It is also to be remembered that government contractors are subject to their own body of "red tape." Contractors complain about the increasing number and complexity of regulatory and statutory requirements. Attempts by universities to apply their own administrative regulations to the FFRDCs managed by them also has generated conflicts and posed problems.

## A Government Research Institute

In its 1962 report to the President on Government Contracting for Research and Development, the Bureau of the Budget recommended that consideration be given to the establishment of a new type of agency, to be called a Government Research Institute (GRI) (Bureau of the Budget, 1962). This would provide for the establishment, within the government, of an agency with a suitable research environment, and provision of personnel and administrative practices adapted to its unique mission. The objective was to achieve in the administration of certain research and development programs necessary flexibility, while maintaining appropriate accountability. The Comptroller General in 1969 urged that a proposal for a GRI again be considered, but to date none has been established.

The National Institute of Education (NIE), established by Congress, was given some, but not all, of the attributes envisioned for a GRI. For example, the institute director was given authority to appoint technical or professional employees as were deemed necessary to carry out the institute's function without regard to the civil service laws and the Classification Act. The director also had authority to establish and maintain such stipends and allowances as were necessary to procure the assistance of highly qualified research fellows (NIE, 1972). Regrettably, the 20 percent of the staff exempted from the civil service were treated as "political appointments" when administrations changed. The NIE was disbanded in the 1980s.

NIH already possesses most of the attributes of a GRI. If Congress were to enact legislation authorizing NIH to establish a personnel system with the flexibility appropriate for a research institution, NIH would be, both in name and in fact, the equivalent of a GRI.

### A Government Corporation

NIH does not meet the criteria to be a government corporation. It is neither revenue producing nor potentially self-sustaining; it does not sell commercial services to the public. Corporate flexibility is dependent on the corporations ability to finance its operations from revenues and borrowings. Agencies that are designated as corporations, but are financed by appropriations, such as the Legal Services Corporation, face the same problems as any other agency and may have even less flexibility. For example, GS-18 is the salary cap for the Legal Services Corporation. Government corporations are subject to the civil service laws and regulations in their chartering legislation. The systems of business-type budgeting and commercial auditing prescribed by the Government Corporation Control Act are unsuited to programs that are not intended to be self-financing.

The chapter thus far has discussed some forms of private organization, some forms of government organization that have elements of the private sector, and some purely public models. The committee rejects these as unsuitable for NIH for the following major reasons:

- NIH does not generate substantial revenues (government corporation, all forms of privatization that are self-sustaining).
- the distinctive contribution of the intramural program would be lost (sale of assets, FFRDCs).
- the administrative upheaval would be very costly.

- there is no reason to believe that any of these models would be any more likely to confer the flexibility that NIH could secure in its present form (independent agency).

The President's Commission on Privatization, which made recommendations on such public functions as housing, education, medicare, prisons, and air traffic control, refrained from making any recommendations with respect to NIH. This was stated to be because of the "technical complexity" of the issues involved, a recognition of the difficulty and sensitivity of devising ways to transfer the intramural program activities to the private sector (Report of the President's Commission on Privatization, 1988).

To some extent, we could gain the advantages of privatization by removing some of the unnecessary and inefficient regulations under which NIH is currently managed. There is no reason why NIH could not benefit from the removal of unproductive constraints that prevent it from competing for scientific talent with the private sector and from operating more efficiently.

## ADDRESSING PROBLEMS THAT EXIST UNDER THE PRESENT ORGANIZATION

To address the most serious problems identified in the previous chapter, the committee examined a variety of solutions that other government agencies facing similar difficulties have adopted without undergoing major reorganizational upheaval. These agencies have established precedents from which the committee believes NIH might benefit. No one approach fully suits the special circumstances of NIH. Therefore, the committee selected features of different models, relying most heavily on a recent National Institute of Standards and Technology (NIST) demonstration and the statutory authority of the Uniformed Services University of the Health Sciences (USUHS).

The committee's major purpose was to design a strategy that would provide NIH with the necessary tools to compete in highly competitive labor markets. To accomplish this, personnel reforms should be characterized by the following:

- a means of exceeding the federal salary cap when necessary to compete for some types of personnel; to reward those who undertake added administrative responsibilities, such as the scientific directors; and to avoid excessive wage compression, i.e., bunching of salaries around the federal civil service cap of $72,500 for GS-level employees;
- a portable system of retirement, so that university and industry personnel would not be disadvantaged by spending part of their career at NIH;

- a system that allows those in the commissioned corps to enroll without a major penalty in loss of benefits accrued.
- the ability to hire personnel quickly, without bureaucratic delays;
- a system that links performance to pay in ways that fit the needs of a scientific organization;
- substitution of a budgetary limitation on payroll for full time equivalent (FTE) ceilings.

## National Institute of Standards and Technology

Although it had a very low turnover rate, below 5 percent, the NIST[1] in the Department of Commerce was concerned about its ability to attract the quality of professional and technical staff it needed for the future. Like other federal agencies, NIST was frustrated by the hiring constraints, pay structures, and staffing limitations imposed by the civil service system. NIST closely examined a personnel demonstration at the Naval Weapons Center at China Lake, a project that experimented with simplified position classification, a new pay for performance system, and greater flexibility in setting salaries. In 1987, NIST obtained a congressional mandate to undertake its own five-year demonstration covering most of its 3,000 employees.

A major feature of the demonstration is the simplified NIST classification system illustrated in Figure 4-1. Similar occupations are grouped together in career paths and pay bands that replace civil service grades. The chief advantage of such a system is greater flexibility and ease for line managers in classifying jobs and rewarding performance. For example, employees who in the past might have been frozen at the top step of a grade will now have greater potential for movement upward in the much broader pay bands. Under such a scheme, NIH could devise an analogous system, such as the one proposed in its 1983 scientific faculty proposal, whereby the scientific staff could be organized in pay bands that correspond to university faculty rank.

Another advantage of the NIST system is streamlined hiring authority. Where once it required 3 months to a year to employ a scientist because of the procedural interplay with the Office of Personnel Management (OPM), such personnel as scientists, engineers, and others in shortage occupations can now be added to the payroll within a few weeks. Moreover, a recruitment bonus of up to $10,000 may be used to attract particularly promising candidates. For occupations not deemed to be in short supply, an agency-based staffing process allows supervisors to advertise positions and to hire non-government candidates without OPM approval.

[1]Formerly the National Bureau of Standards.

FIGURE 4-1

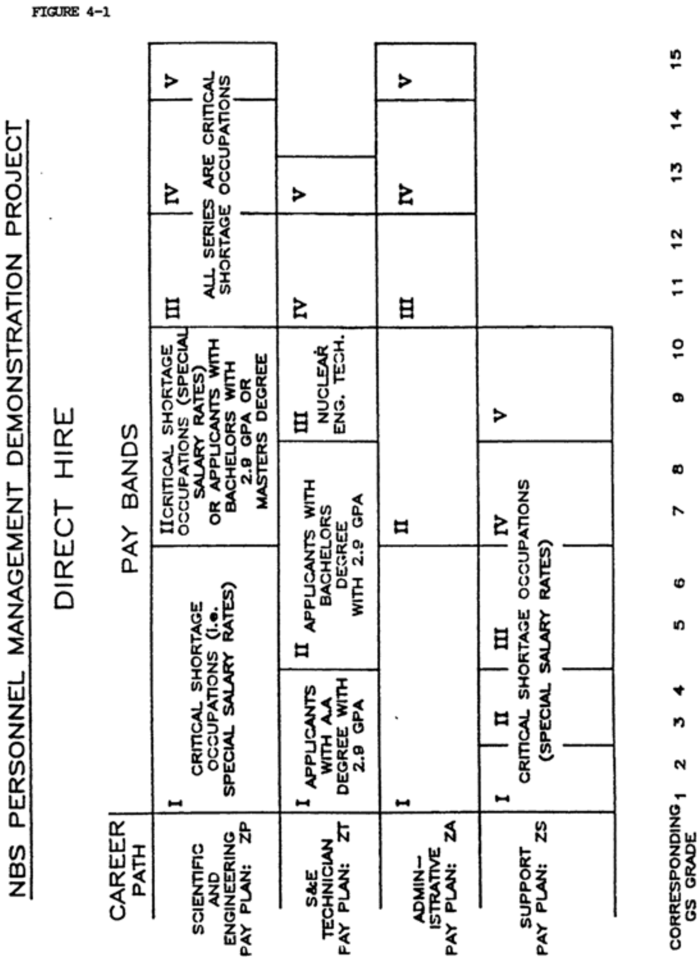
FIGURE 4-1
NBS PERSONNEL MANAGEMENT DEMONSTRATION PROJECT
DIRECT HIRE
PAY BANDS
CAREER PATH
SCIENTIFIC AND ENGINEERING PAY PLAN: ZP
S&E TECHNICIAN PAY PLAN: ZT
ADMIN-ISTRATIVE PAY PLAN: ZA
SUPPORT PAY PLAN: ZS
I
II
III
IV
V
CRITICAL SHORTAGE OCCUPATIONS (i.e. SPECIAL SALARY RATES)
CRITICAL SHORTAGE OCCUPATIONS (SPECIAL SALARY RATES) OR APPLICANTS WITH BACHELORS WITH 2.9 GPA OR MASTERS DEGREE
ALL SERIES ARE CRITICAL SHORTAGE OCCUPATIONS
APPLICANTS WITH AA DEGREE WITH 2.9 GPA
APPLICANTS WITH BACHELORS DEGREE WITH 2.9 GPA
NUCLEAR ENG. TECH.
CRITICAL SHORTAGE OCCUPATIONS (SPECIAL SALARY RATES)
CORRESPONDING GS GRADE
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

NIST has also created various mechanisms through its pay administration system to retain staff. Three types of pay increases are possible. First, all employees who receive at a minimum a fully successful performance rating are eligible for a pay increase based on a regular assessment of the comparability between NIST positions and similar private sector positions. Second, depending on the level of performance, an employee can expect a performance pay increase, the size of which is determined by the current salary, career path, and the pay band salary range. For example, a scientist in a pay band equivalent to GS 13–14 can merit an 8–10 percent pay hike with an outstanding rating, but only a 2 percent with a fully satisfactory rating. Third, employees are also eligible for performance bonuses of up to $10,000 per annum.

Further adding to NIST's arsenal for retaining staff is a special retention bonus of up to $10,000, as well as an option to offer a sabbatical after 7 years of federal service. Helping to soften the effects of wage compression and the reluctance of scientists to accept administrative burdens, there is a 6-percent-of-base-pay differential for supervisory positions.

Many of these facets of the NIST demonstration would prove useful for addressing some of the problems faced by NIH with its inflexible personnel system. There are, however, a number of features absent from the demonstration. The NIST model has no provision for exceeding the total monetary compensation of Executive Level I (currently $99,500), which NIH needs to compete in the physician labor market. Members of the Senior Executive Service (SES) who most often impinge on this cap were excluded from the NIST demonstration. Also, there is no provision for portability of retirement benefits as a means of attracting faculty from universities.

An aspect of the NIST demonstration that NIH might wish to alter is the manner in which comparability with the private sector is determined. The NIST Director is authorized to adjust the ranges of pay bands based on surveys of total compensation paid to persons in positions in private sector firms and universities that are similar in levels of work and responsibility. The adjustments are made, however, not on comparability across specific occupations, but on the basis of the total market basket of NIST employees (P.L. 99-574, 1987). For example, in a recent survey, the salaries of NIST electrical engineers were found to lag approximately 12 percent behind the private sector, while the average for all employees lagged about 6 percent behind. NIH might choose to have more flexibility to compete in selected labor markets by adjusting salaries on an occupation-specific basis.

As a practical matter, the ability to perform accurate comparisons of total compensation, taking into account the value of benefit packages that include such components as vacation and sick leave, is limited and costly. NIST has yet to engage in such comparisons. Furthermore, the ability to alter current federal benefits, such as health insurance and leave, by means of demonstrations is highly proscribed by statute, although NIST has the option to add new benefits in the future if it so desires.

## Uniformed Services University of the Health Sciences (USUHS)

The USUHS has been cited by a number of observers as a potential model for restructuring NIH. A number of features of this agency of the Department of Defense are worth exploring, in conjunction with the NIST model, because USUHS has overcome some of the limitations inherent in the NIST approach.

Authorized by act of Congress in 1972, the university was established to "educate career-oriented medical officers for the military services." The first medical school class entered in 1980. Located virtually across the street from NIH, USUHS is headed by a Board of Regents, which reports directly to the Secretary of Defense. Approximately half of the faculty are commissioned military personnel. Concerned that federal service would not attract a sufficiently high caliber faculty, Congress stipulated in the authorizing legislation:

> The Board, after considering the recommendations of the Dean, shall obtain the services of such military and civilian professors, instructors, and administrative and other employees as may be necessary to operate the University. Civilian members of the faculty and staff shall be employed under salary schedules and granted retirement and other related benefits prescribed by the Secretary of Defense so as to place the employees of the University on a comparable basis with the employees of fully accredited schools of health professions within the vicinity of the District of Columbia. The Board may confer academic titles, as appropriate, upon military and civilian members of the faculty (P.L. 92-426, 1972).

The university operates two civilian personnel systems—the general schedule and schedule A. The faculty, employed under schedule A, do not have civil service tenure, and are in the Teachers Insurance and Annuity Association/College Retirement Equity Fund (TIAA/CREF) retirement system. As indicated in Table 3-13 in Chapter 3, USUHS does not differ greatly from NIH salary patterns except for some key senior positions. In these cases, USUHS exceeds the federal salary cap. In determining comparability, USUHS confers with the personnel offices of the local medical schools to determine base pay, rather than total compensation. Although USUHS clinical faculty may practice medicine on the outside, there is no formal medical practice plan from which they derive additional income. Faculty may compete for limited budgeted research funds, but many also compete for extramural research grants.

In addition to the advantage of legislative authority to match medical school salaries—even those above the federal salary ceiling—USUHS has another mechanism that affords an extra measure of flexibility. In the mid-1980s, Congress established the Henry M.Jackson Foundation for the Advancement of Military Medicine to undertake cooperative enterprises with the university. This authority permits a wide latitude of activities in which the foundation and USUHS may share staff, space, equipment, and other resources. The foundation can accept, hold, administer, invest, and spend gifts made to the university for the purpose of supporting academic chairs, teaching, research, or demonstration projects. Foundation funds have been raised through the efforts of a number of voluntary groups, and even through the combined federal campaign. In practice, the university makes broad use of this resource. For example, employees such as technicians are hired through the foundation and equipment is purchased with as much flexibility as is found in the private sector. Recently, Congress appropriated $1 million to the foundation for the establishment of an endowed chair (Kinnamon, K.E., Associate Dean for Operations, USUHS, interview, 1988).

The Jackson Foundation is not a unique phenomenon within the federal government. The National Park Foundation was also established by Congress as a charitable and nonprofit corporation to accept, receive, solicit, and administer gifts for the benefit of the National Park Service, its activities, or its services. The foundation board of directors consists of the Secretary of the Interior and the Director of the National Park Service, ex-officio, and no fewer than six private citizens appointed by the Secretary of the Interior. The foundation is “off budget,” and its employees are not considered to be federal employees. With a broad charter to encourage private gifts “to benefit the National Park Service and its activities,” the foundation, whose current assets of approximately $8 million, has financed activities ranging from preparation of guide books to acquisition of facilities and real property (P.L. 92-209, 1967).

NIH already has some latitude to accept donations. Although NIH cannot solicit funds, Section 497 of the Public Health Service Act confers upon the Secretary of DHHS authority to accept gifts on its behalf for the acquisition of grounds, the erection of buildings, the purchase of equipment, or the maintenance of NIH facilities. Donations of $50,000 or over may be acknowledged by establishment of suitable memorials to the donors. The Director of NIH can readily accept “conditional” gifts, such as a donation for bone marrow transplants or for use by a specific investigator, but rules that govern unconditional gifts to individual institutes are stringent to avoid conflict of interest (Ficca, S., Director, Office of Administrative Management, National Heart, Long, and Blood Institute, interview, 1988).

As of FY 1988, NIH has gift funds totaling $6.3 million; of this amount, $1.9 million has been obligated, and another $2.9 million has been invested. The institute directors use these funds to sponsor scientific symposia and conferences; to purchase scientific equipment, supplies, and books; and to provide for official entertainment of visitors. Money in the Patient’s Benefit Fund provides materials, services, or activities that contribute to the morale of patients, e.g., reading and entertainment materials and recreational activities (Anne Summers, Chief, NIH Budget Execution and Financial Reports Branch, personal communication, 1988).

NIH already has some experience with using a foundation to accomplish special purposes with the Foundation for Advanced Education in the Sciences (FAES). Incorporated in 1959, the FAES, with total assets of $14 million "fosters and encourages scientific research and education, and facilitates communication among scientists by whatever means may be practical." To accomplish its educational mission, FAES sponsors courses for NIH scientific staff, continuing medical education, cultural programs, and fellowship and grant management (FAES Annual Report for FY ended May 31, 1987).

In addition, private foundations can provide funds for specific studies at NIH. For example:

- One foundation has funded diabetes studies at NIDDK.
- A foreign government, wanting NIH to conduct research in a particular area, donated several thousand dollars to a foundation that used funds to support such a study (fellowships, salaries, etc.).
- A pharmaceutical company donated money to FAES, which will administer NIH postdoctoral fellowships (NIH staff interviews, 1988).

Several advantages of congressionally chartered foundations cannot be obtained by an agency from gift authority alone. Foundations can solicit funds openly and invest them. They allow for systematic, fair, and accountable use of funds from donors. Finally, creative administration can accomplish some objectives (travel to overseas meetings for scientists, for example) free of many of the usual bureaucratic and political constraints often faced when government procedures must be followed.

Although USUHS benefits greatly from special authorities, such as the Jackson Foundation, flexibility in offering retirement systems such as TIAA-CREF, and its unique ability to pay salaries above Executive Level I, the agency is not immune from some of the same problems that many government agencies face. For example, USUHS officials acknowledge difficulties and delays in the area of space and procurement. Also, for many of its general schedule employees at the technical and support level, the same personnel strictures with which NIH contends are present.

## Senior Biomedical Research Service Proposal

NIH management, increasingly concerned over disparities between what it can pay and compensation offered by private and nonprofit institutions, made an attempt at improvement with its proposal for a Senior Biomedical Research Service (SBRS) consisting of the following features:

- The SBRS would be established in the excepted (non-competitive) service. The Secretary of DHHS would appoint its members and determine their compensation. To be considered for appointment, an individual would have a doctoral-level degree in an appropriate field and meet the minimal qualification standards for GS-15. The proposed bill provides that basic pay for members of the SBRS would range from GS-15, Step 1, to the rate of pay for Executive Level IV.
- Supplemental pay would be authorized for members with significant administrative responsibility and/or significant scientific accomplishments. The total compensation ceiling could not exceed 110 percent of the rate of pay for Executive Level I. The proposal also provides that for a few scientists (not more than 3 percent of the members of SBRS) the supplemental pay may be greater, with a total ceiling (currently $164,175) roughly comparable to the mean compensation (base salary plus supplement) of chairmen of internal medicine departments in medical schools.
- Limitations on accumulation of annual leave would be removed for members.
- SBRS members recruited from universities would be able to continue their membership in TIAA/CREF.
- Transfers would be facilitated between the Commissioned Corps of the PHS and the SBRS.

As the original NIH proposal made its way through DHHS and the Senate in the form of S. 2222, the NIH reauthorization bill of 1988, the provision allowing 3 percent of the SBRS members to earn almost $165,000 was eliminated (S. 2222, 1988).

## IMPROVING THE NIH MANAGERIAL ENVIRONMENT

There is no single, simple organizational solution to the problems that now confront NIH. The belief that organizational independence, or conversion to a government corporation, or some form of privatization, would automatically provide exemptions from restrictive laws and regulations is a misconception. Regardless of form, agencies possess only that degree of operating and financial flexibility specifically provided by federal law and regulations and their enabling statutes.

Congress may be disposed to grant greater freedom to some types of organizations than to others, but there is no certainty that it will do so in any given situation. In some cases, reorganization may result in merely trading one set of problems for another equally irksome. Whatever organizational alternative may be proposed, exemptions from laws and regulations generally applicable to federal employees and agencies must be justified by convincing evidence demonstrating the need for special treatment.

The committee took special care in considering structural options for NIH. First, it recognized that it was dealing with a large, complex agency charged with extremely vital and politically popular programs. Second, there are important extramural/intramural interrelationships—especially NCI, which represents about one third of the intramural budget. Third, NIH is a highly successful research enterprise and enjoys international prestige. Fourth, NIH already has a degree of budgetary support and an administrative setting that has freed it from many of the obstacles that frustrate managers in less favored agencies.

Thus, in developing a strategy for the NIH of the future, the committee is concerned with anticipating problems and potential needs of a strong resource, rather than with bolstering a disorganized or faltering agency. This means that any proposed change should help ensure that an effective and highly regarded agency remains so, and continues to move forward in attacking the nation's gravest medical challenges. The committee's intent is to seek cost-effective alternatives that address real needs, and those clearly emerging, and to do so with the least feasible disruption of a highly successful agency.

## CONCLUSIONS AND RECOMMENDATIONS

The committee believes that an amalgam of the authorities represented by the NIST demonstration, the USUHS, and the Senior Biomedical Research Services proposal is needed to provide flexibility in NIH personnel administration. The committee emphasizes that its analysis of NIH problems does not support the need for a major shift in all NIH salaries to parity with academia or industry. What the committee is seeking is a mix of appropriate tools for NIH management to operate in highly competitive labor markets at all levels of personnel. These tools include a personnel demonstration project, a foundation, and relief from personnel ceilings.

### Competing for Personnel

The committee recommends that Congress authorize NIH to develop and implement a personnel demonstration project tailored to overcome the deficiencies of the current system. The committee suggests that the project should feature:

- simplified hiring, classification, and pay administration authority similar to the demonstration now being conducted by the NIST;
- an occupation-specific pay standard based on surveys of market comparability;
- the ability to exceed the federal pay ceiling in justifiable circumstances;
- portability of retirement benefits between non-federal employment and NIH.
- a limit on personal services costs, in lieu of employment ceilings, as a way of controlling personnel costs.

The committee agrees with NAPA that the imposition of ceilings on numbers of personnel makes little management sense in most agencies. Such ceilings are especially damaging when they force agencies into inappropriate substitution of personnel (e.g., postdoctorates for technicians, the contracting of functions better performed in-house), and otherwise prevent the most efficient response to demands generated by an agency's mission. The NIH budget should be the controlling factor in expenditures. If oversight of personnel management is needed, it can best be achieved by review of NIH's spending on personal services, which includes contracts as well as employees.

Any legislation designed to enhance the effective utilization of the NIH intramural research staff should exclude NIH from administratively imposed limits on numbers of employees. Such a provision is to be found in H.R. 4417, reported by the House Committee on Science, Space, and Technology, to establish a National Technical Information Corporation. The Indian Health Service has been exempted from these limits.

Although the demonstration authority would permit NIH to exceed the federal salary ceiling, the committee recognizes that this flexibility should be used with restraint, because of political sensitivities, and to avoid morale problems that would be caused by the recruitment of career scientists at salary rates substantially in excess of those of current employees. The committee believes that NIH ought to be able to attract a limited number of the most outstanding, established scientists, whose presence would inject new intellectual stimulation to the program. Scientists of this stature command salaries and resources beyond the level that NIH is likely to match without a program designed to avoid political and morale problems. The committee believes that creating a small number of time-limited, exceptional appointments would avoid such problems. Creating endowed chairs outside the federal civil service system would enable NIH to provide competitive salaries substantially higher than the federal civil service ceiling, and to provide other resources such as equipment, travel expenses, and technical support staff. To accomplish this, the committee recommends that Congress charter a foundation to permit the private support of up to ten endowed chairs for distinguished investigators. The creation of a foundation similar to those established for USUHS and the National Park Service, would permit funds to be raised from the private sector. However, the committee intends that the foundation's receipt of private funds be modest, so as not to significantly channel funds away from other biomedical research endeavors. For this reason, the committee suggests that Congress consider a fund-matching, or other cost-sharing, provision. Furthermore, this would show that the federal government is not abrogating responsibility for staffing one of its own laboratories. Appropriate mechanisms would have to be put in place to prevent any appearance of conflict of interest on the part of those contributing to the endowment of such chairs.

## Improving Management and Quality Control

The major objective of this chapter, thus far, has been to reaffirm the present organizational structure and location of NIH and its intramural program within the federal system. In doing so, we have suggested a variety of authorities to strengthen the hard of NIH management in coping with endemic administrative problems.

The committee concluded that its responsibilities are not adequately discharged without addressing long-standing concerns about the Director's lack of flexibility to manage the affairs of NIH for which he bears broad responsibility. The committee also believes that further progress can be made in allowing the review process to better serve the resource allocation decisions facing scientific directors.

Chapter 3, in exploring problems associated with administrative layering within DHHS, describes the limited freedom of the Director to make relatively simple management decisions on such matters as space, foreign travel, and promotions and to have the discretion to adjust the resources of NIH to accomplish purposes that do not fall in the purview of any single institute.

Maintaining an Administratively Efficient NIH in the PHS In a background paper prepared for the committee, NIH argued that:

> The barriers to the continued scientific excellence of the NIH intramural research program are administrative in nature, created to govern the expenditure of public funds, not biomedical research. They are imposed upon the intramural program through successive organizational layers, and managed, interpreted, and implemented by staffs that are constantly changing and far removed from the dynamics of biomedical research. They are affecting

visibly the critical mass of talent assembled in the intramural program and its underlying research infrastructure.

The paper concludes that the two most satisfactory solutions are (1) to bring incremental changes in the status quo, or (2) to establish the total NIH as a free-standing entity within the federal government. The paper states that "some change is clearly desirable to permit the intramural program and the NIH greater flexibility in dealing with bureaucratic controls that limit biomedical research progress" (NIH, 1988).

The committee seriously considered the arguments put forth by NIH, and concluded that problem-specific change was the most appropriate solution. As discussed earlier in this chapter, independent agencystatus is no guarantee of freedom from bureaucratic constraints, and puts at risk the favorable position that NIH holds with Congress in support of its activities.

The committee also seriously considered whether NIH would function more effectively as a health agency reporting directly to the Secretary of DHHS. It felt that the advantages to NIH of being part of a strong PHS outweigh the disadvantages. Among these advantages is that strong Assistant Secretaries function both as advocates for NIH, including its intramural program, and as buffers against excessive political pressures from Congress and the Administration. In addition, maintaining existing elements of the PHS under the Assistant Secretary for Health strengthens capacities for coordinated approaches to public health policy issues. Consistent with IOM's 1984 report on the organizational structure of NIH, the committee does not wish to see biomedical research separated from those agencies that deal with the preventive and service delivery aspects of health.

Not only did the committee believe that the advantages to NIH of being part of the PHS outweigh the disadvantages, it also was not convinced that problems of FTE ceilings, travel limits, control of procurement, and space management are a result of NIH's subordinate location. All of these problems, with the exception of travel ceilings, originate outside of DHHS in laws and regulations enforced by agencies such as the OMB and the General Services Administration. The committee found that, although these problems were exacerbated by the administrative layering within DHHS, they were not sufficiently serious to warrant removal of NIH fromeither DHHS or the PHS. Moreover, the scope of this study could not include an assessment of the impact of such action on the other health components of DHHS or on the NIH extramural program.

Nonetheless, there are serious limitations that weaken the management capabilities of the Director of NIH. The committee believes that efforts to micromanage NIH from the Office of the Assistant Secretary for Health are counterproductive and reduce the efficiency of NIH in carrying out its mission. The committee recommends that the Secretary of the Department of Health and Human Services delegate to the Director of NIH the authority to make decisions on administrative matters without being subject to review by the Office of the Assistant Secretary for Health. Assistant Secretaries for Health have not always taken responsibility for detailed administrative oversight for NIH. From the perspective of this examination of the intramural program, broad policy guidance and interagency coordination are more valuable activities than administrative functions that could be performed more efficiently if NIH were given greater latitude in decision making.

Director's Discretionary Fund NIH is a confederation of institutes, each having a high degree of autonomy. As such, it cannot always respond well to new issues, emergencies, or research opportunities that do not clearly fall within the scope of one institute. In these circumstances, the Director needs the resources to initiate intramural activities across institute lines, without imposing on the independence of the institutes. The committee recommends that Congress appropriate annually to the Director of NIH an amount no less than $25 million to be used to address emerging issues and special inter-institute research opportunities.

Recognizing the need for a response to "complex biomedical emergencies," in 1985 Congress authorized the Secretary of DHHS to allow the Director of NIH to expedite grant review, and increase by up to 50 percent grants or contracts that support research relevant to an identified emergency. To date, funds have not been made available under this authority. Other groups, such as the IOM (1984) study of the organizational structure of NIH and the President's Commission on the Human Immunodeficiency Virus Epidemic (1988), also recommended that funds be made available to the Director of NIH for use at his discretion. These recommendations have not been implemented.

Assuring Quality The committee has four major recommendations designed to assure that the quality of the intramural program be maintained at a high level for the future. The first three relate to assuring that the review process can be seen to be rigorous and leads to wise use of intramural resources. The last recommends a program to make NIH competitive for a share of the most promising young investigators in the country.

The Review Process To improve the external validity of the review process, the committee recommends that a panel chaired by a member of the Director's Advisory Committee should be established to monitor the intramural research program review. The functions of this panel would be to monitor the integrity of the process, while taking care not to replicate the activities of the boards of scientific counselors. Its oversight should focus on areas that are most vulnerable to criticism, namely the selection of the reviewers and the implementation of recommendations.

Each of the scientific directors and their intramural programs should be reviewed as a whole every four years by an external group. The review report should be submitted to the director of the relevant institute, the NIH Deputy Director for Intramural Research, the Director of NIH, and the Director's Advisory Committee. The committee believes that such a review is necessary because of the importance of ensuring the vitality of the intramural program. The intent of the periodic review is not to limit arbitrarily the term of the scientific director, but rather, to put in place a process that will ensure vigorous leadership. Under the general leadership of the institute director, and with the advice of the Board of Scientific Counselors, the scientific director exercises a decisive role in influencing the intramural program. The right person in this position functions not merely as a caretaker, but a force for excellence. The responsibility of the scientific director requires that he/she have the scientific vision needed to allocate intramural resources productively, as well as to function as a highly skilled manager. Therefore, the committee recommends that those holding the position of scientific director receive additional compensation. This will become possible under the recommended personnel demonstration program.

An NIH Scholars Program In the past, most young scientists have entered NIH as postdoctoral fellows immediately after completing their M.D. or Ph.D. programs. They usually lack postdoctoral research training, which they then receive at NIH under the guidance of a senior scientist. If they perform well, they are asked to remain in the institute, where they gradually advance up the scientific and administrative ladder. They usually remain for a number of years under the immediate direction of a senior scientist. While independence is often achieved, it may be delayed past the time when it would be achieved if the individual changed institutions.

This system has the advantage that it provides a constant supply of junior workers who assist in the projects of senior scientists. In many instances, these postdoctoral fellows receive outstanding training. When they finally achieve independence, many of them become highly productive scientists and make up the core of NIH. Although the system has worked well in the past, it does not assure a steady flow of new ideas. Postdoctoral fellows who train at NIH under a particular laboratory chief tend to reflect the scientific slant of that preceptor. When they mature as scientists, they tend to continue an existing tradition, but they may not be able to bring as effectively new ideas and approaches to the general scientific community of NIH.

At universities this problem is solved by the continual recruitment of new assistant professors who were trained in other institutions. These young scientists bring new disciplines that they have learned during their postdoctoral fellowships. Although NIH recruits each year forresearchers at the assistant and associate professor levels (GS-13, −14), NIH does not have a mechanism designed specifically to allow it to recruit systematically the best young minds.

The committee believes that this problem can be solved by the creation of an NIH Scholars Program. This proposed program to recruit the brightest young investigators at the most creative stages of their careers could be modeled on an existing program at the Whitehead Institute of the Massachusetts Institute of Technology and on the Rockefeller Scholars Program. Aside from providing a continuing source of highly qualified young researchers, the program would open opportunities for the scientific directors of each institute to oversee the development of new initiatives outside of the existing laboratory structure. The committee believes that it is in the best interest of both NIH and the overall biomedical research community that NIH have a process designed to ensure that it systematically recruits its share of the best young investigators available.

<u>The committee recommends that Congress authorize and appropriate funds for an NIH Scholars Program in which outstanding young investigators at the assistant professor level would be appointed on a competitive basis to independent, non-tenured positions in the intramural program</u>.

The program would have several features to make it as attractive as other prestigious appointments now available in academic institutions. To achieve this, prospective scholars must perceive that the institutes are competing to employ the best talent that universities have to offer, that resources are available to make this experience highly productive, and this is seen as a major step toward an outstanding career. Up to six scholars per year should be offered appointments for six years as independent basic or clinical researchers. Each institute could propose up to three candidates per year. A sum of $1.5 million over 6 years could be allocated to support each scholar and the research needs. It is proposed that the Director of NIH fund this program from his newly-created discretionary appropriation. The committee believes that this sum ($250,000 per year on average) would be adequate to pay for the salary of the scholar and necessary technicians, as well as to provide for minor space modifications and necessary supplies and equipment. The Director should establish procedures for selecting scholars. The selections should be made on the basis of several criteria, the most important being the excellence of the candidate's record and plans for the future.

Each NIH scholar should be appointed for six years. After the sixth year in the program, the scholar would be eligible for appointment to a tenure or non-tenure position in the sponsoring institute or in another institute of NIH. However, such a position is not guaranteed. The beginning salary should be approximately equal to that of an assistant professor in a basic science department of a medical school for Ph.D.s, and in a clinical department for M.D.s. After the first year, the salary could be increased at the discretion of the scientific director of the institute.

It is anticipated that some of these scientists would remain at NIH following the 6-year term, thereby increasing the pool from which NIH leadership is selected. It is also expected that some of these scholars will take positions of leadership outside the NIH—furthering NIH's traditional role of seeding the extramural research community.

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# Appendix A

# ORGANIZATIONS AND INDIVIDUALS PROVIDING TESTIMONY REGARDING THE NIH INTRAMURAL PROGRAM

American Academy of Dermatology, Evanston, IL. D.Martin Carter, M.D., Professor and Senior Physician, Laboratory for Investigative Dermatology, Rockefeller University.

American Academy of Neurology, Minneapolis, MN. Theodore L.Munsat, M.D., President. Roger Rosenberg, M.D., Councillor, Scientific Affairs.

American Association of Neurophathologists, Inc., Professional Affairs Committee, Charleston, SC. Michael N.Hart, M.D., Vice President for Professional Affairs.

American Academy of Orthopaedic Surgeons, Washington, DC. Thomas C.Nelson, Executive Director (Ex-Officio).

American Academy of Otolaryngology, Washington, DC. Marlene W.Karakashian, Ph.D., Director of Research Development.

American Academy of Pediatrics, Elk Grove Village, IL. Richard M.Narkewicz, M.D., President. Gretchen V.Fleming, Ph.D., Director, Department of Research.

American Association for the Advancement of Science, Washington, DC. Alvin W.Trivelpiece, Executive Officer.

American Association for Clinical Chemistry, Inc., Washington, DC. Ronald E.Whorton, M.P.H., Executive Vice President.

American Association for Dental Research, Washington, DC. John A.Gray, Ph.D.

American Association of Colleges of Nursing, Washington, DC. Geraldene Felton, Ed.D., R.N., President. Professor and Dean, University of Iowa, School of Nursing.

American Association of Colleges of Pharmacy, Alexandria, VA. Carl E.Trinca, Ph.D., Executive Director.

American Board of Medical Specialties, Evanston, IL. Donald G.Langsley, M.D., Executive Vice President.

American Dental Association, Health Foundation, Chicago, IL. Enid A.Neidle, Ph.D., Assistant Executive Director, Scientific Affairs.

American Dermatological Association, Inc., Iowa, IA. John S.Strauss, M.D., Secretary.

American Federation for Clinical Research, Washington, DC. Lynn Morrison, Director for Public Policy.

American Heart Association, Dallas, TX. Howard E.Morgan, M.D., President.

American Liver Foundation, Cedar Grove, NJ. Thelma King Thiel, President and Chief Operating Officer.

American Medical Association, Chicago, IL. James H.Sammons, M.D., Executive Vice President.

American Psychological Association, Washington, DC. Alan G.Kraut, Ph.D., Executive Director for Science.

American Society of Human Genetics, Bethesda, MD. Elizabeth M.Short, M.D., Chair, Public Policy Committee.

American Society for Microbiology, Washington, DC. Moselio Schaechter, Ph.D., Past President. Chairman, Department of Molecular Biology and Microbiology, Tufts University School of Medicine.

Association of Academic Health Centers, Washington, DC. Roger J.Bulger, M.D., President.

Association of American Medical Colleges, Washington, DC. Robert G.Petersdorf, M.D., President. John F.Sherman, Ph.D., Executive Vice President. Thomas J.Kennedy, Jr., M.D., Associate Vice President.

Boston University School of Public Health in the School of Medicine, Boston, MA. John D.Groopman, Ph.D., Associate Professor of Toxicology. Associate Director, School of Public Health.

Breast Cancer Advisory Center, Kensington, MD. Rose Kushner, Executive Director.

Conjoint Council on Surgical Research, Los Angeles, CA. William P.Longmire, Jr., M.D., Chairman.

Cystic Fibrosis Foundation, Bethesda, MD.

Endocrine Society, Bethesda, MD. Gerald D.Aurbach, M.D., President. John T.Potts, Jr., M.D., Past President.

Epilepsy Foundation of America, Landover, MD. William M.McLin, Executive Vice President.

Federation of American Societies for Experimental Biology, Bethesda, MD. Howard K.Schachman, President.

Howard Hughes Medical Institute, Bethesda, MD. George F.Cahill, Jr., M.D., Vice President for Scientific Training and Development.

International Life Sciences Institute, Washington, DC. Alex Malaspina, President.

Joslin Diabetes Center, Boston, MA. C.Ronald Kahn, M.D., Director, Elliott P.Joslin Research Laboratory.

National Council for International Health, Washington, DC. Russell E.Morgan, Jr., Ph.D., President.

National Institute of Child Health and Human Development, National Institutes of Health, Bethesda, MD. Richard D.Klausner, M.D., Chief, Cell Biology and Metabolism Branch.

National Institutes of Health, Bethesda, MD. Dr. David J.Lipman, (Mathematical molecular biologist).

National Institute of Mental Health, Bethesda, MD. Mark A.Smith, M.D., Ph.D., Medical Staff Fellow.

National Kidney Foundation, Inc., New York, NY. Dolph R.Chianchiano, Associate Director.

National Organization for Rare Disorders, Inc., New Fairfield, CT. Abbey S.Meyers, Executive Director.

Pharmaceutical Manufacturers Association, Washington, DC. John F.Beary, III, M.D., Senior Vice President for Science and Technology.

Penn State College of Medicine, Hershey, PA. C.McCollister Evarts, M.D., Senior Vice President for Health Affairs. Dean, College of Medicine.

The Robert Wood Johnson Foundation, Princeton, NJ. Leighton E.Cluff, M.D., President.

St. Louis University Medical Center, St. Louis, MD. Arthur E.Baue, M.D., Vice President for the Medical Center.

State University of New York Health Science Center, Brooklyn, NY. Donald J.Scherl, M.D., President.

State University of New York at Stony Brook, NY. Dr. Jacob Bigeleisen, Department of Chemistry.

University of Connecticut Health Center, Farmington, CT. James E.Mulvihill, D.M.D., Vice President and Provost for Health Affairs and Executive Director.

University of Southern California School of Medicine, Los Angeles, CA. Thomas H.Kirschbaum, M.D., Professor, Department of Obstetrics and Gynecology.

University of Tennessee, Memphis, TN. The Health Science Center, James C.Hunt, Chancellor.

Yale University, New Haven, CT. Herbert Y.Reynolds, M.D., Professor of Internal Medicine and Head, Pulmonary Section. Vice President, American Thoracic Society.

# Appendix B

# NIH VISIT ON MAY 25, 1988

Attendees at Meeting of Institute of Medicine Study Committee
Study of Strategies to Strengthen the Scientific Excellence of the
NIH Intramural Research Program

INSTITUTE OF MEDICINE COMMITTEE:
- Harold Shapiro, President, Princeton University
- Charlotte V. Kuh, Executive Director, Educational Testing Service
- Robert G. Petersdorf, President, Association of American Medical Colleges
- Elmer B. Staats

INSTITUTE OF MEDICINE STAFF:
- Ruth E. Bulger, Director, Division of Health Sciences Policy
- Michael L. Millman, Study Director
- Jessica Townsend, Associate Study Director
- Carlotta C. Molitor, Research Associate

NIH STAFF:
- W.F. Raub, Deputy Director
- J.E. Rall, Deputy Director for Intramural Research

NIH SCIENTISTS (NAS MEMBERS):
- E.R. Stadtman, NHLBI
- R. Chanock, NIAID
- D.C. Gajdusek, NINCDS
- D. Stetten, OD
- R. Brady, NINCDS
- G. Felsenfeld, NIDDK
- H. Tabor, NIDDK
- D. Davies, NIDDK
- G. Ashwell, NIDDK
- W.A. Hagins, NIDDK
- L. Sokoloff, NIMH
- I. Dawid, NICHD
- I. Pastan, DCBD/NCI
- W. Paul, NIAID
- F. Goodwin, NIMH
- M. Gellert, NIDDK
- R. Purcell, NIAID
- R. Wurtz, NEI

SENIOR STAFF FELLOWS/VISITING ASSOCIATES:

| | |
|---|---|
| B. Pfeffer, NEI | SSF |
| R. Miletech, NINCDS | SSF |
| T. Sargent, NICHD | SSF |
| D. Kastner, NIAMS | SSF |
| T. Shimada, NHLBI | VA |
| L. Wolff, DCBD/NCI | SSF |
| R. Myerowitz, NIDDK | SSF |
| R. Lister, NIAAA | VA |

## HHMI/NIH RESEARCH SCHOLARS:

Ahron Friedberg, State University of New York at Buffalo

Steven Wolff, Duke University

David Pezen, Loyola University of Chicago Stritch School of Medicine

Laurie Beitz, University of North Carolina

Eric Hsi, University of Michigan

Eric Janis, Johns Hopkins University

## SENIOR SCIENTISTS AT NIH:

S.Broder, DCT/NCI

M.Frank, NIAID

J.Piatigorsky, NIDR

R.Klausner, NICHD

E.Korn, NHLBI

D.Sachs, DCBD/NCI

J.Weinstein, DCBD/NCI

G.Aurbach, NIDDK

D.Lipman, NIDDK

M.Lippman, DCT/NCI

M.Hallett, NINCDS

D.Singer, DCBD/NCI

J.Gallin, NIAID

A.Levine, NICHD

A.Rabson, DCBD/NCI

# Appendix C

# SUMMARY OF ACHIEVEMENTS OF NIH INTRAMURAL PROGRAMS

The development of new treatments and cures for human diseases most often begins with discoveries that elucidate basic, fundamental processes in cell function. However, which of the so-called "basic science" discoveries will lead to clinical amelioration of disease is not easy to predict and, thus, such discoveries serve as irreplaceable foundations for the complex of knowledge required for advances in health care and disease prevention. Important contributions to both basic science and clinical practice have been made by the NIH intramural program. The partial list that follows is divided into four categories and has been assembled from the responses of individual institutes to a request by the study directors.

The first category encompasses a group of advances with direct clinical applications. The second category contains some discoveries that lie between the distinctions of clinical versus basic science advances. Thus, this second category gives examples of discoveries whose direct clinical applications are clearly foreseeable but not yet fully realized. The third category, basic science, outlines numerous contributions of the NIH intramural program to an extended understanding of normal and abnormal physiological and cell biological processes. Finally, the fourth category lists some special programs or studies that do not easily fit into the other categories.

Information supplied by the National Institutes of Health.

## ADVANCES IN CLINICAL PRACTICE AND APPLICATIONS

— Development of new vaccines against important bacterial infections of infants and children, including Hemophilus influenzae type B, pertussis, and typhoid.
— Development of a curative therapy for cystinosis, an inborn error of metabolism.
— Discovery of AZT as an effective agent against human immunodeficiency virus (HIV or AIDS virus).
— Development of chemotherapy to preserve kidney function in patients with systemic lupus erythematosus.
— Development of effective treatments for alpha 1-antitrypsin deficiency state which have additional application to biochemical abnormalities in emphysema.
— Advances in surgical treatment of hypertrophic cardiomyopathy.
— Development of new strategies for use of coronary bypass surgery in treatment of chronic stable angina.
— Significant contributions to technical and theoretical development of nuclear magnetic resonance and optical spectroscopy.
— Demonstration that the drug, 5-azacytidine, increased fetal hemoglobin synthesis thus exerting beneficial effects in patients with severe beta thalassemia or sickle cell anemia.
— Development of treatments which lessen the symptoms of malignant pheochromocytoma and identification of a marker, neuropeptide Y, which distinguishes this tumor from other pathological conditions.
— Development of methods to assess the tone of the sympathetic nervous system; these have been useful in diagnosis and treatment of hypertension.
— Demonstration that the drug, cyclophosphamide, induces long-term remission of symptoms in systemic vasculitis.

## ACHIEVEMENTS IN BASIC SCIENCE THAT ARE CLOSE TO CLINICAL APPLICATION

— Discovery of the human immunodeficiency virus (HIV) to be the cause of AIDS.
— Discovery of the causative agent of Lyme Disease.
— Establishment of ways to separate the various abnormalities in immune system function resulting from AIDS infection.
— Development of a vaccine, effective in animals, for hepatitus B virus.
— Discovery of the first cancer-causing retrovirus in humans.
— Determination of the complete structure of the human receptor for IgE, an immunoglobulin which plays a role in allergic attacks.
— Demonstration that some patients with angina have normal external coronary arteries, but have abnormal arteries within the wall of the heart.
— Assignment of the human globin genes to chromosomes 11 and 16.
— Determination of the molecular defects in various types of abnormal lipoprotein metabolism.
— Discovery of "slow" viruses which cause degenerative brain disease.
— Definition of the molecular events which underlie Gaucher's Disease.
— Demonstration that persons recovering from liver damage caused by exposure to halothane, an anesthetic, produce antibodies to a liver enzyme.
— Discovery that persons with hypertension vary in their responses to salt intake. Some are salt-sensitive and other's are salt-resistant as a result of differing levels of dopamine, which affects kidney function.
— Description of the processes that cause interstitial lung disorders and identification of the important role played by T-helper lymphocytes in sarcoidosis.
— Discovery of polyomavirus, Rauscher virus, and Moloney leukemia and sarcoma viruses.

— Demonstration of the role of iron in the regulation of gene expression.
— Identification of genes that code for cellular proteins involved in the breakdown and processing of cancer-causing substances, toxins, and drugs.
— Discovery of an oncogene that led to the identification of the gene for cystic fibrosis and of another oncogene that codes for a growth factor.
— The measurement of brain glucose metabolism with positron emission tomography, which allows for assessment of brain activity in relatively discrete brain regions. Such studies have shown reliable patterns of brain damage in patients with Alzheimer's disease.
— Discovery of the toxic effects of the enzyme, aldose reductase, in diabetes. Such effects probably underlie the complications of diabetes, such as blindness and nerve damage. Inhibitors of the toxic enzyme have been developed and are now in clinical trials.

## ACHIEVEMENTS IN BASIC SCIENCE

— Identification of different patterns of gene expression during the various stages of blood cell maturation and differentiation.
— Demonstration of central role of the enzyme, protein kinase C, in tumor promotion.
— Discovery that, in muscle fibers, myosin forms two types of crossbridges with actin, thus refining existing knowledge of the biomechanical basis of muscle contraction.
— Demonstration of the processes by which proteins in a cell are structurally modified within the cell to allow for specific physiological actions.
— Definition of mechanisms involved in acetylcholine receptor changes in development of the junction between nerve and muscle.
— Demonstration of the role of cyclic AMP in the expression of proteins required for development of synapses between neurons.
— Characterization of different types of the protein phospholipase C, important in signal transduction mechanisms in cells, and demonstration that the sub-types of this protein are differentially present in specific cells and tissues.
— Development of tissue culture methods for mammalian brain cells which allow extremely precise electrical, biochemical, and physiological measurements to be made.
— Development of recombinant DNA techniques, the first cloning of a mammalian gene.
— First demonstration of the molecular basis of antibody diversity.
— Discovery of plasma cell tumor induction in mice, which led to the development of hybridomas (cells formed by the fusion of an antibody-producing cell with a tumor cell).
— Discovery of interleukin-2, which is produced by a certain immune system cells called T lymphocytes; interleukin-2 also promotes the proliferation of T lymphocytes.
— Determination of the structure and function of the receptor for interleukin-2.
— Maintenance in culture conditions of individual nephrons, the working unit of the kidney, allowing measurement of a variety of kidney functions that include transport mechanisms and the role of osmolytes in normal and abnormal conditions.

— Experiments leading to a new hypothesis that suggests that NADH (a critical molecule involved in energy metabolism), contained in small, intracellular compartments called mitochondria, may be central to the regulation of energy metabolism in tissues such as the heart and kidney.
— Definition of mechanisms involved in muscle contraction, including the biochemistry of actin polymerization, a necessary chemical reaction during muscle contraction.
— Discovery of a new class of molecules, similar to myosin of muscle cells, which probably function in movements of non-muscle cells.
— Identification and cloning of the earliest genes to be expressed during embryo growth in vertebrates and determination of the products of those genes.
— Discovery of transforming growth factors (alpha and beta), which are substances secreted from cells that have been changed in culture from normal to malignant (transformed). These factors stimulate growth of normal cells and may play a role in normal developmental mechanisms.
— Cloning of basic myelin protein, a part of the substance, myelin, which forms an insulating sheath around certain parts of neurons called axons. Disturbances in myelin formation underlie certain neurological disorders.
— Demonstration that biological molecules such as cyclic AMP, glucocorticoids, nerve growth factor, and activators of protein kinase C can act together to regulate the genes that code for enkephalin and neuropeptide Y, substances found to function in the brain and many other tissues.
— Discovery of the mechanism for pertussis toxin effects on signal transduction across cell membranes in which a toxin enzyme structurally modifies a membrane protein required for transmembrane signalling. The type of structural modification of proteins effected by toxin enzymes is also effected by normal cellular enzymes resulting in a variety of cell regulatory mechanisms.

— Determination of the amino acid sequence of a human plasma apolipoprotein and of the gene structure of several plasma apolipoproteins.
— Gene transfer and expression in intact animals using retroviral vectors.
— Achievement of successful “gene therapy” of a defective cell in tissue culture by microinjection of a cloned normal gene.
— Demonstration that adoptive cellular transfer can cause regressions of human cancer (LAK/IL-2).
— The enzyme, RNA polymerase, is essential for the normal synthesis of RNA. The enzyme has been studied in terms of the mechanism by which it joins certain molecules to form a perfect copy of the genetic message necessary for protein synthesis.
— Contributions to the knowledge of structure, organization, expression, and evolution of the proteins that form the lens of the eye. Changes in these proteins occur during the development of cataracts.
— Analysis of the effects of eye movements on visual processing by single neurons that transmit visual messages. The combination of behavioral and physiological techniques with computer modeling has allowed for precise studies of the neural organization of the visual system.

## SPECIAL PROGRAMS AND ACHIEVEMENTS

— Development of nationwide cancer maps and cancer atlases.
— The Diet, Nutrition, and Cancer Program: An intramural initiative involving diet and nutrition intervention studies and the newer chemoprevention studies and trials.
— The Surveillance, Epidemiology, and End Results Program (SEER) is an intramural program which provides a statistical survey capability for tracking cancer incidence, morbidity, and mortality in the nation.
— Demonstration of the utility of gas chromotography to drug, steroid, and vitamin analysis.
— Introduction of the applications of mass spectrometry.
— Quantitation of amounts of luminal narrowing caused by atherosclerotic plaques in patients with acute myocardial infarction, healed myocardial infarction, angina pectoris, and sudden coronary death.
— Extensive program of evaluation of prosthetic heart valves and the mechanisms of their failure.
— Development of useful equipment and technology including: closed circuit blood centrifuge, disposable membrane artificial lung, countercurrent chromatography, global analysis for time-resolved fluorescence spectroscopy, the porous bottomed culture dish, a purification method to standardize hemoglobin in the development of a blood substitute, and a new stopped-flow calorimeter for studies of drug binding to DNA.
— The Baltimore Longitudinal Study on Aging has continued now for thirty years with a subject pool of more than 1,000. Recently, data from this study has shown that decreased cardiac output is not an automatic sequela of age. This study has also provided evidence that an individual's personality tends to be remarkably stable over long periods of life experience.

# Appendix D

# BIBLIOMETRIC ANALYSIS

## DATA SOURCES AND DEFINITIONS

### Journal Sets

This study analyzes data from an NIH data set established in 1981 and based on the approximately 1,000 journals that are indexed by both the National Library of Medicine's Medline and the Science Citation Index (SCI). The data are both valid and consistent over time, and cover almost all NIH intramural research publication activity from 1973 to 1984. Although this data base does not permit comparison of NIH intramural and extramural research support activities, it offers opportunity for comparison with all publications whose authors' addresses were given as universities or medical schools. Data have been accumulated into three four-year sets so that sufficient numbers of publications would be included to provide reliable comparisons.

### Publication Counts

The number of papers assigned is based on fractional counts of author institutions. For example, if an NIH intramural scientist co-authors a paper with two authors in two different universities, each institution receives credit for 0.33 publication.

### Activity Index

The Activity Index measures how active the intramural program is in a given field by dividing the percent of intramural papers in a field or subfield by the percent of all papers in that subfield.

### Citation Frequency

Each time a paper in a data set is cited by the author(s) of subsequent papers in the same or any other covered journal, the article is credited. Older articles have time to accumulate more citations and are not, therefore, directly comparable with more recent papers. For the present analysis, a ratio has been calculated for each of the three four-year accumulations of papers: the average number of citations per paper received by intramural papers has been divided by the average number of citations per paper received by those authored by university and medical school investigators. These ratios permit comparison of intramural with academic average citation experience over time.

### Field Coverage

All journals included in the SCI data bases have been classified by Computer Horizons, Inc. (CHI) into "Fields" and "Subfields" (or disciplines). A subfield may include one or more disciplines; the decision by CHI to combine disciplines was based on size considerations or on the fact that some journals publish papers in two or more related disciplines. Attention was focused primarily on subfields included in the fields of clinical medicine and biomedical research. The revolution in basic biomedical science methods that has occurred since the Watson-Crick elucidation of the roles of DNA and RNA in the biological and biomedical sciences has blurred distinctions, even among the subfields designated "Biomedical Research." The distinctions and the titles are retained for convenience in analysis and discussion.

## FINDINGS

Findings from the bibliometric analysis are summarized in Chapter 2. Details of the analysis of intramural program performance in scientific subfields follow.

There are 27 specific clinical and basic biomedical subfields in which the NIH intramural program can be considered most active: (a) activity indexes were greater than 1.0 and more than 40 papers were produced during the 1981–1984 period, or (b) more than 100 papers were produced though activity indexes were less than 1.0 (radiology-nuclear medicine and surgery). Eighteen of these 27 subfields produced more papers during 1981–1984 than during 1977–1980. Of these, 11 can be regarded as bedrocks of strength in the intramural program. Included are eight in clinical medicine—dermatology-venereal disease, endocrinology, hematology, immunology, pathology, radiology-nuclear medicine, respiratory system, and surgery; they are joined by three basic biomedical subfields—biochemistry-molecular biology, cell biology-cytology-histology, and parasitology. This group contains the two largest intramural subfields, in which the largest numbers of NIH papers are published (biochemistry-molecular biology, and immunology) and 4 that barely met criteria for inclusion among the 27 most active subfields—dermatology and respiratory research (barely enough papers) and radiology-nuclear medicine and surgery (low activity indexes).

These 11 subfields have been singled out because, over the entire period 1973–1984, they have exhibited stability or increasing strength in quality measures as well as in productivity. Some, such as dermatology, respiratory system, and parasitology, have exceptionally large percentages of papers among the most highly cited 10 percent (32 to 44 percent). It should be noted, however, that when numbers are small, as they are in two of these subfields, only a few outstanding performances are required to achieve sizable percentage records. For the very large subfields, such as endocrinology, immunology, biochemistry-molecular biology, and cell biology-cytology-histology, the opposite is true. Activity indexes for these subfields range from 2.3 to 4.3, and their papers play a significant part in defining the top 10 percent, yet more than 20 percent of endocrinology and immunology papers were in that highest decile in 1981–1984. Both journal influence and citation measures of the cell biology group have improved throughout the 1973–1984 period; top citation decile papers increased from 12 to almost 18 percent. The largest intramural subfield, biochemistry-molecular biology, despite its size has maintained a strong record of performance in general—one far superior to that of the university-medical school record (15.2–16.2 papers in the top citation decile as compared with 9.7–9.9).

Five subfields that have significantly increased the numbers of papers produced have been less fortunate in maintaining quality. Cardiovascular system, dentistry, pharmacology, physiology, and microbiology each have suffered declines in at least two of the three quality measures employed—average journal influence, ratio of intramural citations per paper to academic citations per paper, and percent of papers in the top citation decile. In all of these subfields, the number of papers in the top citation decile declined, and in all except physiology, citation per paper ratios also declined. The average journal influence rating declined precipitously for physiology papers, and markedly for all others except dentistry. These results suggest that problems may have been encountered in attracting high-level new junior talent, as well as in retaining or replacing leadership.

Two additional subfields that have steadily increased the number of papers produced, but do not fit in either of the categories above, fertility and neurology-neurosurgery, have stable but unimpressive records on quality measures. Average journal influence measures are approximately the same as the academic averages, and citation measures are only slightly above them.

Six major subfields that substantially increased their production of research papers during the 1977–1980 period but produced fewer papers during the 1981–1984 period are general and internal medicine, embryology, hygiene-public health, biophysics, tropical medicine, and virology. In all of these subfields except embryology, average journal influence ratings remained higher than those in the corresponding academic sector (substantially higher for general and internal medicine). Citations per paper ratios were fairly stable, but for each of these subfields the percent of papers in the highest citation decile declined noticeably. It appears likely that these subfields lost or suffered turnovers among leading scientists on their staffs, or possibly other kinds of disruptions occurred, resulting in reduced performance. General and internal medicine continues very strong, but in 1977–1980, of 639 papers, almost 33 percent were among the most highly cited 10 percent of all U.S. papers, while in 1981–1984, with 596 papers, only 23.9 percent appeared in the highest citation—still impressive, but a substantial reduction.

In addition to the six subfields noted above, cancer and genetics-heredity produced fewer papers in 1981–1984, following substantial growth in the 1977–1980 period. Almost all of the intramural research in these subfields is supported by the National Cancer Institute (NCI). Unlike other institutes, whose obligations in constant dollars continued to increase between 1977 and 1980 (the period affecting 1981–1984 publications), NCI's obligations declined steadily and substantially (NIH Data Book, 1982). The high correlation that exists between budgetary changes and publications three years later (r=.90 in NIH studies) suggests the possibility that the NCI intramural programs in these two subfields, and in virology, may have been affected, as extramural programs certainly were. Although the number of cancer and genetics-heredity papers produced in 1981–1984 declined, quality measures improved for both fields (except the average journal influence of cancer papers, which declined slightly). In 1977–1980 the intramural program produced almost 11 percent of all U.S. cancer papers. The percentage dropped to 8.7 in 1981–1984, but it is apparent that intramural papers played a substantial role in defining the top citation deciles. Intramural performance increased steadily in each four-year period, as the percent in the highest citation decile grew from 12 to 18 percent; academic institutions placed only 9.4 to 9.8 percent of their papers at this level.

Ophthalmology was the only one of the most active intramural program disciplines to decline in every measure of size and quality between the mid-1970s to the mid-1980s. The activity index remained greater than 1 (1.4, down from 2.2), but top decile performance declined from a peak of 22.3 to 15.1 in 1981–1984.

There are 17 subfields, not including miscellaneous clinical and miscellaneous biomedical research, in which relatively few NIH intramural scientists publish. In most of these "small" subfields, fewer papers were published in the early 1980s than in the late 1970s, though in eight of them relatively high citation records improved. In 1981–1984, the following subfields placed more than 20 percent of papers in the highest citation decile: allergy 31.8, arthritis 23.6, otorhinolaryngology 22.2, pediatrics 30.7, urology 33.3, nephrology 23.5, biomedical engineering 47.8, and microscopy 33.3. It must be remembered that these statistics are based on small numbers of papers. Nevertheless, the evidence here suggests that some areas of research are being held back, or at least not being encouraged or given the opportunity to grow in spite of the strength and prominence of existing scientific staff, while some other more highly favored (or highly budgeted) disciplines may be promoted beyond the capacity of NIH to attract the best available talent.