BIOMEDICAL RESEARCH MANPOWER

Report of the Conference held October 1-3, 1973
at the Battelle Seattle Research Center, Seattle, Washington
Sponsored by the Council of Academic Societies
of the Association of American Medical Colleges
Hosted by the University of Washington School of Medicine

B I O M E D I C A L

R E S E A R C H

M A N P O W E R

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CONFERENCE OVERVIEW

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In June of 1973 the inexorable elimination of the National Institutes of Health and National Institute of Mental Health research training programs for developing young biomedical investigators had so clearly become the policy of the Federal Government that a meeting of representatives from the major universities responsible for research training was called. These institutions recognized that their role must now extend beyond responding to requests for developing talented youth and become one of participating actively in the planning for preservation of research capability in the sciences basic to medicine. An invitational conference held in Seattle, October 1-3, 1973 drew representatives from 20 university medical schools, voluntary health agencies, private foundations, the Office of the Assistant Secretary for Health, Department of Health, Education, and Welfare, the National Institutes of Health (NIH), and the National Academy of Sciences.

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The Association of American Medical Colleges (AAMC), through its Council of Academic Societies (CAS), and the University of Washington School of Medicine arranged the meeting. The Battelle Memorial Institute kindly provided its excellent facilities for the conference.

For two-and-one half days 59 participants met in plenary and small workshop sessions. The principal focus was on developing ideas and plans for the assumption of increased responsibility by nongovernmental agencies for planning and monitoring the development of the Nation's biomedical research manpower. Three major groups were considered by the Conference participants as inseparably interdependent in carrying forward research talent development: (a) the faculties of the Nation's colleges and universities; (b) the informed laity, particularly those in the voluntary health agencies; and (c) the legislative and administrative branches of the Federal Government. Major supporting roles are expected from private foundations and the commercial-industrial sectors of society.

The recommendations emanating from the meeting place great responsibility on the nongovernmental sector for monitoring and planning the research training effort of the country in the future. This is not intended to imply that the Congress, the National Institutes of Health, the Department of Health, Education, and Welfare, and the National Science Foundation do not have principal responsibility for the Nation's biomedical research manpower policies. However, recent experience demonstrates that educational training policies can be

radically changed by politically motivated decisions. A more stable element in policy development must be included if public expectations for improved health through research are to be met. This element must come from the responsible input of professional scientists and their academic institutions.

RECOMMENDATIONS AND RATIONALE

Three principal recommendations were derived from the Biomedical Research Manpower Conference.

RECOMMENDATION 1

That the Congress establish a national commission, possibly under the auspices of the National Academy of Sciences, to help in determining the appropriate role for the Federal Government in the support of biomedical research and research training with particular attention to the mission of its principal agency, the National Institutes of Health. Such a commission should have broad representation from business, labor, consumers, foundations, the scientific community, and other interested parties.

RECOMMENDATION 2

The Association of American Medical Colleges should take a leadership role in the evaluation of needs for manpower development and should call upon the assistance of the voluntary health agencies. This program should also involve the biomedical scientific societies participating in the Council of Academic Societies of the AAMC in order to obtain a broad consensus of needs. The informed support of business, labor, and individual citizens should be utilized to promote a rational, national biomedical research and research training policy. The academic medical community, the professional biomedical scientific associations, and the voluntary health agencies should also develop mechanisms to foster public education regarding the implications of biomedical research programs on the public and individual health of the American citizens.

RECOMMENDATION 3

A study group should be established to evaluate biomedical research from the standpoint of optimizing contributions to health care and suggesting guidelines for the allocation of resources to basic and applied research. This group will require input of biomedical scientists and should include among its topics for consideration the factors which contribute to the career choice of students who enter biomedical research.

The task forces which met in Seattle to consider the issues related to biomedical research manpower training arrived at these recommendations based upon their evaluations of needs, priorities, evaluation mechanisms, the problems of finding public support, and establishing new funding mechanisms. The workshop participants also considered that a high priority item must be the development of mechanisms for interaction between the institutions and universities associated with biomedical research and research training and the appropriate nonfederal agencies, foundations, and voluntary health groups as well as the various arms of the Federal Government interested and involved in the support of biomedical research and research training.

The improvement of health as a stated national goal has received strong bipartisan support and major federal funding. Support for biomedical research grew sharply between 1950 and 1968. Throughout this entire period, approximately 15 percent of the extramural research budget of the NIH was assigned to support training in the biomedical sciences. During the late 1960s health care was supported through Medicare legislation and development of health care workers through health manpower legislation. The expanding cost of the latter two

programs and shifts in policy have resulted in increased competition for federal dollars, reduced support for research, and withdrawal of federal dollars for research training. Termination of support for research training was based upon two major arguments:

1. That the cost of training represents an equity for the individual leading to increased earning capacities; therefore, he should pay for the training himself; and

2. That the market forces, rather than central planning, should determine the entry of biomedical research workers into the various fields.

The members of the conference take issue with both of these assumptions. The first premise ignores the very large costs involved in training for research and the limited enhancement of earning power through attainment of research expertise. The argument that market forces will determine the entry of biomedical scientists ignores the long pipeline between entry and attainment of independence as a biomedical scientist.

Research and research training are national assets and not regional ones. They receive their funding from national agencies because only they can rise above the local constituencies and because they represent a partnership between the universities and institutions pursuing research and the sources of funding. Inasmuch as there is presently no dispassionate body to speak for either the Congress or the Executive Office relative to biomedical research needs, the

conference participants propose the establishment of a national commission to help determine the role of the Federal Government in the support of biomedical research and research training. This commission would have the responsibility of proposing public policy relative to research activity and manpower training. The commission should have broad representation including representatives from labor, industry, medical schools and other components of the university, institutes pursuing biomedical research, consumers, voluntary health agencies, foundations, and other appropriate representatives of interested parties.

The necessity of bringing together the voluntary health agencies, the professional societies, the medical and nonmedical institutions pursuing biomedical research and research training, and the National Institutes of Health and other national organizations associated with the support for biomedical research and research training to reach common goals in pursuit of support for these efforts to evaluate programs to produce biomedical scientists, is clearly recognized. To accomplish this, a scientific registry of all programs to produce biomedical scientists should be developed by the commission suggested under Recommendation No. 1, which will have university, state, federal, and public input. Thus, the establishment of a mechanism for continuous monitoring of the optimal levels of biomedical support, of the entry of biomedical scientists by discipline, and of the outcome of training programs can be established. This mechanism should be responsive to the best advice of the scientific community as to direc-

tions of research so as to insure an adequate investment in noncategorical research as well as in special initiatives. It should be capable of influencing the flow of manpower into biomedical science in general, and specific disciplines in particular, based upon its best perception of scientific opportunities and of market forces. The latter are substantially influenced by the level of support for biomedical research by the Federal Government. Until such a mechanism can be established, the conference recommends that approximately 15 percent of the extramural NIH budget continue to be allocated to research training.

Further, the conference participants recommend that the present mix of mechanisms of research training be maintained until further evaluation can assess its relative success; namely, the departmental training grants, direct fellowships for pre- and post-doctoral support, and inclusion of research associates in research grants as well as the research career development awards; and that within this mix the training grant be accorded a high priority. The conference participants also recommend that research training grants and fellowships which tend to strengthen institutions with established reputations for research productivity be supplemented by continuation of capitation support of all medical schools and of the Health Science Advancement Fellowship that is offered only to trainees in departments that do not have training grants. These latter two mechanisms, therefore, offer an egalitarian balance between these programs. Loans should also be made available as an additional modality useful to a small percentage of students or research trainees who cannot afford the increased costs

of this mechanism. It is suggested, however, that this mechanism is the least satisfactory for guaranteeing an adequate flow of biomedical research manpower in that it is unattractive to students from disadvantaged backgrounds who most need the help. Where the loan mechanism is employed,it is recommended that payback be possible by service such as research, teaching, or activities in the health care system, rather than by dollars.

In addition to the federal sources indicated above, every effort should be extended to recruit nonfederal sources for supporting training in biomedical research. Generous programs are already in effect through several voluntary health agencies and foundations, but these need to be enlarged wherever possible. Thus, an association of the voluntary health agencies, together with the other parties recommended previously, should gather to review from time to time the status of research training funds and research funds so that the most effective application of these funds can be made to help meet the national health needs.

Money is potentially available through industry and other interested parties for biomedical research and research training. Therefore, the conference participants would encourage the development of a consortium in an effort to recruit increased funds from both general industry and those immediately concerned with biomedical sciences as well as foundations and voluntary health agencies not currently involved with funding biomedical research training. Such funds could be more economically administered by the central agency previously rec-

ommended but yet could retain the advantage of identifying the recipient with the donor.

Needs can be assessed by the establishment of a data base that would include the present number of investigators as well as training opportunities funded by federal and nonfederal sources. The funding of research grants and training grants, the distribution of investigators, training grants, and trainees, and the turnover of each of these individuals will be important to monitor. Areas in which there are deficiencies in the current supply of investigators and in which there are qualified, unemployed investigators need to be clearly identified. The extent to which the presence or absence of stipends affects the access to research training for disadvantaged groups also needs to be monitored. Thus, a study group which will continue to investigate biomedical research from the standpoint of the optimization of research contributions to health care and the allocation of these resources to basic and applied research can take into account factors derived from an adequate, data-based analysis of the needs, appropriate means for evaluating the quality of the training and research programs, and participation of the appropriate parties to determine priorities as needs change.

It is hoped that these recommendations can be implemented through the establishment of the appropriate groups with the help and support of the AAMC as the principal catalyzing body to permit their establishment.

A PROGRESS NOTE

The major thrust from the Seattle Conference was an effort by the participants to develop recommendations which were pragmatic rather than utopian. In the several months since the close of the conference some progress in achieving its goals has been made:

1. *As a result of the AAMC lawsuit, impounded FY 1973 funds for research training have been released, and the Federal Government has resumed sponsorship of research training activities.*

2. *The AAMC has been working closely with certain voluntary health agencies to increase public awareness of the importance of research training and to stimulate an increase in nonfederal funds for the support of biomedical research training.*

3. *An ad hoc group of Washington-based individuals has met to evaluate whether there is need for increased data collection concerning both federal and nonfederal training activities as well as the career pathways of previously trained scientific manpower in the basic medical sciences. Following an initial meeting of this group it became clear that most of the basic data needed to assess manpower trends are currently being collected by various agencies and associations. It was the consensus that a major new effort to accumulate data about manpower training was unnecessary. However, it was also apparent that there is an acute need for closer liaison between the various groups collecting data.*

In order to fully accomplish the goals of the Conference on Biomedical Research Manpower the scientific community and the institutions of medical education must take increased responsibility for educating the public-at-large about the critical role that biomedical research training plays in efforts to improve the Nation's health.

CONFERENCE GOALS

*August G. Swanson, M.D.**

During the late 30s, the 40s, and the early 50s, distinguished members of the biomedical research community of this country and individuals in government concerned with improving the research capability of our institutions in areas directly and indirectly related to health, formed a fruitful coalition from which developed the National Institutes of Health. The partnership between science and government was looked upon as a positive working relationship, and the counsel and guidance of highly skilled professional scientists were sought eagerly. This partnership was facilitated by the tremendous need for technological development during the war years of the early 40s.

The development of research capacity in our academic institutions during the 20 years from 1950 to 1970 was remarkable; and this research capacity was coupled with the education and training of many young, biomedical scientists. The programs which evolved during those years permitted the provision of richer educational opportunities for bright, young minds than did the traditional apprenticeship method of having established investigators hire research assistants.

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This collaboration between the academic community and governmental institutions has now become a tenuous arrangement. We are told by high administration officials that national priorities have changed, and the support of research of all kinds is looked upon as a dubious investment. However, the American people still believe that the academic medical centers will carry on research programs on their behalf in order that their health may be better preserved. This unspoken expectation, although denied by the administration, must be looked upon as a mandate to continue our national research effort, even though the responsibility for planning and operation must now fall upon our institutions acting both singly and together.

The time has come when we must develop a new, rational, and defensible strategy for the provision of a continuous flow of new, young biomedical research talent into our research laboratories. The strategy must be rational, defensible, and geared to predictable needs. The question is: can the institutions, and the disciplines within them, work together to effect a new and workable coalition and can this coalition eventually interact effectively with those in all branches of the federal establishment who remain concerned with the short- and long-range future of our Nation's biomedical research potential?

However, the purpose of this meeting is not to develop immediate political strategies, but rather to determine whether we can evolve a system for predicting our needs for research manpower, monitoring manpower development, providing sound institutional training sites, and selecting and holding top quality research talent. We in the private

sector are now the last bastion for accomplishing this task. Many of our respected colleagues in the NIH find themselves hamstrung by decisions at higher levels over which neither they, nor we, have control.

Specific mechanisms of financing should be considered secondary to the development of a sound, programmatic plan. If a rational program for sustaining research training can be developed, then strategies for financing can be adapted to meet the program's needs.

The outcome of this conference is unpredictable. Most of the time will be devoted to providing participants opportunities for the exchange of ideas and the development of plans. The best outcome of this meeting will be that it begins a sequence of interactions between institutions and disciplines directed toward a common goal--the maintenance and furtherance of biomedical research on behalf of the citizens of our country and the world.

THE NIH TRAINING ACTIVITIES: A HISTORICAL BACKGROUND

Richard B. Stephenson, M.D. *

The National Institutes of Health (NIH), like virtually every other organization, did not spring full-blown into existence but had a series of precedent activities and events. The Public Health Service, originally established as the Marine Hospital Service in 1798, has been around since the earliest days of the Republic. In 1878 the Service acquired important public health and quarantine responsibilities as the result of enactment of the first federal quarantine laws. This, in turn, led to the establishment in 1887, at the Staten Island Marine Hospital, of the Bacteriological Research Laboratory which was subsequently moved to Washington as the Hygienic Laboratory and which was the immediate forerunner of the NIH.

EARLY LEGISLATION

The most significant landmark, however, leading to the establishment of the National Institutes of Health as we now know them, occurred on May 26, 1930 when the Congress enacted the Ransdell Act, P.L. 71-251,

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*Training Officer, Office of the Director, National Institutes of Health.

which established the National Institute of Health and, among other things, endowed the Public Health Service with clear and broad authority for training:

> Sec. 3 Individual scientists, other than commissioned officers of the Public Health Service, designated by the Surgeon General to receive fellowships, may be appointed for duty in the National Institute of Health established by this act. During the period of such fellowship these appointees shall hold appointments under regulations promulgated by the Secretary of the Treasury and shall be subject to administrative regulations for the conduct of the Public Health Service. Scientists so selected may likewise be designated for the prosecution of investigations in other localities and institutions in this and other countries during the term of their fellowships.

The Ransdell Act marked a pivotal point in the history of biomedical research with the proclamation of a very large and key federal role to conduct and foster such research and coupled it with an emphasis on the need for trained manpower to effectively discharge this role.

It is interesting now to go back and read the transcripts of the legislative hearings that led to the passage of this act. It is very clear that while Senator Ransdell and his colleagues may not have envisaged the $1.5 billion enterprise that the NIH has now become, they were by no means thinking small. They had a dream--and their dream was that one of the most important missions of the great federal biomedical research enterprise would be to attract the minds and talents of the brightest and most talented young people into careers of research against disease. This is a dream that NIH officials have never lost, although they have had a few rude awakenings in recent

years.

Any review of the development and present status of NIH training programs must focus upon several significant aspects of their evolution.

It is important to note that successive legislative authorizations have not limited the training programs of the Institutes; the Congress has specifically and repeatedly sanctioned training broadly for health service and research. As a result, the training programs of the various Institutes have evolved with more variety in philosophy, in objective, in administrative procedures, and in mechanisms of support, than other functional activities of the NIH.

The combination of these authorities, and the manpower demands within the diverse fields related to the various categorical Institutes, resulted initially in efforts designed to improve manpower needed for both the provision of service and the performance of research. It was the recognition in the immediate post World War II era of the wholly inadequate base of scientifically trained personnel in nearly every field related to medicine that led to the major thrusts of the NIH training programs to develop an adequate number of biomedical scientists in the basic sciences as well as the creation of a core group of faculty in the clinical specialties to help meet the anticipated needs for teaching, research, and service in these areas. It must be recalled too, that this was during a time when conservative opinion was strongly opposed to the use of federal funds in the support

of education generally, and medical education in particular, but was tolerant of research and research-related support. Thus, in any given Institute the specific objectives of its training effort have progressively evolved in response to the changing opportunities of the biological sciences and the changing requirements of those areas of medicine that lie within the mission of the Institute.

With these considerations in mind, a brief review of the evolution of the NIH training programs assumes a proper perspective.

EVOLUTION OF INSTITUTES

In 1930, the Ransdell Act (P.L. 71-251) established the National Institute of Health and created a system of fellowships for duty at NIH and at other medical and research institutions. The National Cancer Act of 1937 (P.L. 75-244) established the National Cancer Institute, the first of 10 separate categorical health-oriented Institutes of NIH, and pioneered the Federal Government's first major fellowship program. A few years later, the Public Health Service Act of 1944 revised and consolidated laws pertaining to the Public Health Service (PHS) and gave NIH additional broad legislative authorization for fellowships and training. In 1947, NIH created the Division of Research Grants to administer a broad extramural program of research grants and fellowship awards.

Expansion of NIH into additional disease-oriented fields began in 1948 with the establishment of the National Heart Institute and the

National Institute of Dental Research. In the next year the National Institute of Mental Health was created, followed in 1950 by both the National Institute of Neurological Diseases and Blindness and the National Institute of Arthritis and Metabolic Diseases. The National Microbiological Institute became the National Institute of Allergy and Infectious Diseases in 1955.

During the period 1937-46, the National Cancer Institute (NCI) focused its training efforts in two areas: (a) post-doctoral research fellows, and (b) clinical traineeships for physicians to improve their capability in diagnosis and therapy. For both of these programs, the Institute made awards to individuals based on selection by National Cancer Institute staff. In 1946 NCI expanded its program to encompass predoctoral research fellowships. As the other Institutes came into being, each initiated its own training effort based, in part, on the precedents established by the National Cancer Institute.

The first departure from the pattern of awards to individuals occurred in 1948 with the initiation of undergraduate training grants. These awards were made to specified professional schools to strengthen their undergraduate teaching capabilities in cancer, heart disease, and mental health. The funds thus provided could be used at the institution's discretion for the purchase of equipment, acquisition of instructional material, salary support of faculty, and so on. Rather than provide stipends for individuals in training, these awards sought to strengthen the environment in which the categorical interest would

be pursued. In contrast to the subsequent use of the training grant mechanism, these awards provided the same sum for each institution of a given type. The grants constituted the first direct contribution of funds by NIH for the improvement of the medical curriculum.

In 1950 the National Heart Institute modified the training grant mechanism for use at the graduate level and included funds for training stipends. Award amounts varied from one institution to another, and recipients were selected on the basis of national competition. The grantee institutions were subsequently given increased latitude in the management of the grants by being allowed to select trainees without prior central NIH review and within certain limitations to set the level of individual stipends.

These moves established the general pattern for subsequent NIH programs of this type and led to the emergence of the graduate training grant as the preeminent mechanism in the NIH training effort. Unquestionably, the widespread and imaginative use by NIH of this support device, which provided funds for both improvement of a particular training environment and the financial support of individuals seeking training within the environment, has played the key role in the success of the NIH training enterprise to the present time.

Part-time fellowships, usually for summer work, were initiated in 1954 for medical and dental students. This program was intended to stimulate student interest in research, to permit early identification of research talent, and to expose selected individuals to a research

experience as a supplement to their formal education. In 1957 another program of fellowships was established, permitting medical and dental students to spend a year in research between their preclinical and clinical years. In the same year, a program of training grants to medical schools was also initiated to experiment with new approaches to the identification, selection, and training of medical students for academic careers. In this experimental program, each school was encouraged to work out its own plan for exploring new processes and techniques for the selection and training of medical students. These programs were later supplemented through funds in the stipend category of many graduate training grants to extend coverage of this effort to institutions not having experimental program grants.

It was also at this time that the necessity for concentration on training for the meeting of faculty and research needs became persuasive. As a consequence some training programs without such capability were phased out over the next few years,and the use of the clinical traineeship was diminished.

In 1958 the creation of the Division of General Medical Sciences, now the National Institute of General Medical Sciences (NIGMS), supplied an NIH focus for the support of training in the broad range of fundamental disciplines related to health. This provided the scientific underpinning for the programs of the categorical Institutes, enabling them to concentrate their training efforts in those areas of greatest relevance to the accomplishment of each Institute's mission.

Accordingly, the bulk of predoctoral (pre-Ph.D.) training was concentrated in NIGMS, in part by the transfer of these programs from the older Institutes.

EXPANSION OF PROGRAMS

Through these developments, dating back to 1930 but principally subsequent to World War II, the foundation was laid for the rapid expansion in the NIH programs in the late 1950s and early '60s. By then, broad authorities for training efforts had been enacted, an appropriate confederation of individual institutes created, an array of support devices developed and tested, and a review and selection system based on assessment of merit in national competition by peer judgment established. Surveys had indicated the existence of a set of national circumstances requiring large-scale expansion of the NIH training effort: growing demands for scientists and teachers, an adequate pool of potential trainees, and the imminent growth and extension of the biomedical research effort as the consequence of a national consensus.

By this time, with the exception of the National Institute of Mental Health, the Institutes' manpower programs were oriented mainly toward training for academic medicine. The categorical Institutes concerned themselves particularly with the post-M.D. training of physicians for academic medicine and clinical investigation, and NIGMS concentrated on the basic biomedical sciences with special

emphasis on predoctoral training.

In addition to responding to the developments described above, the NIH manpower effort in the early 1960's involved additional features of major significance. The establishment of General Research Support (GRS) grants, authorized under P.L. 86-98 in 1960, made possible the expansion of biomedical science training through the provision of funds with considerable flexibility in purpose and use at the grantee institution's discretion. In many instances significant portions of these awards have been used for student stipends, for the strengthening of existing departments, and for the initiation of new departments or programs which, when organized and staffed, may then compete successfully for training grant support. The advent of the GRS program also permitted NIH to discontinue as formal programs several activities such as the post-sophomore and part-time student fellowships.

In 1961 the Research Career Award program was initiated to provide more stable salary support for academic research careers. This program incorporated senior research fellowship programs previously undertaken by several of the Institutes. It had two levels: (a) research career development awards, for promising younger scientists just getting well launched in their careers; and (b) research career awards, to permit fully established scientists to devote maximum time to their research activities.

During 1962 the Congress authorized creation of the National Institute of Child Health and Human Development to provide a focal

point for research and training oriented toward the continuing process of growth and development through infancy and childhood on into maturation and senescence. Support in this area further broadened the multidisciplinary training approach, interrelating the developmental and behavioral sciences.

The National Institute of Environmental Health Sciences with broad interdisciplinary responsibilities directed toward research relating to environmental hazards was established in 1968, and the National Eye Institute was created in 1969. There has also been legislation changing the names and giving altered emphasis or responsibilities to certain of the Institutes with the National Heart Institute becoming the National Heart and Lung Institute, National Institute of Arthritis and Metabolic Diseases becoming the National Institute of Arthritis, Metabolism, and Digestive Diseases, and the National Institute of Neurological Disease and Blindness becoming the National Institute of Neurological Diseases and Stroke.

REDUCTION OF PROGRAMS

This brings us up to fairly recent history when the current chain of events was initiated in the Fall of 1968. The discretionary portion of the federal budget was under intense scrutiny, and the training budget of the NIH absorbed a cut of approximately $14 million, primarily in predoctoral fellowships. In the Fall of 1969 when the fiscal year 1971 budget was being prepared, it became clear that the

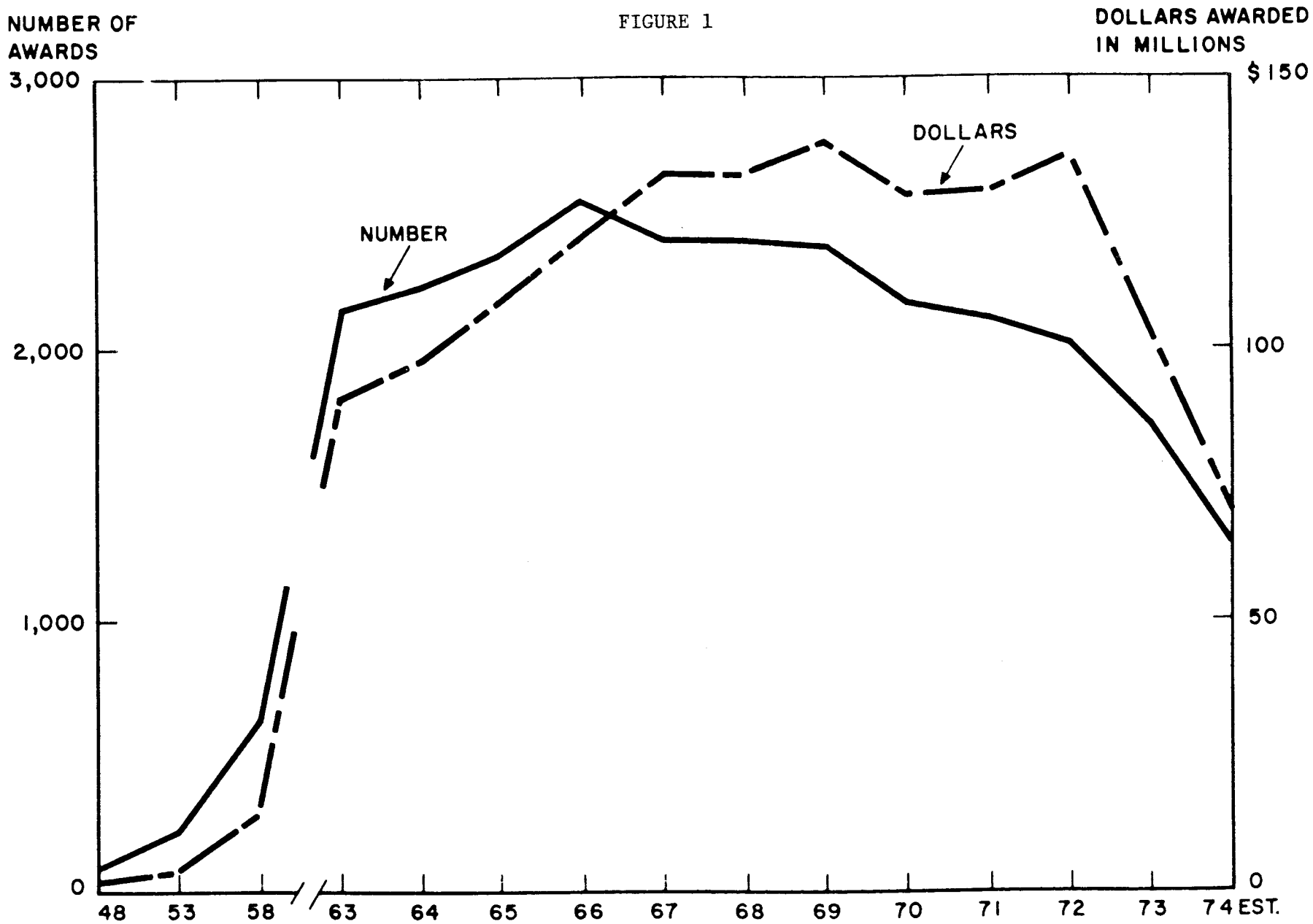
Bureau of the Budget intended to impose severe reductions on Federal support of graduate training in the sciences. This resulted in "no new start" policies on the traineeship programs of the National Science Foundation and other Federal science-supporting agencies and a proposal to do the same to the NIH training budget. Secretary Finch, however, in a letter to the Director of the Bureau of the Budget in December, 1969, strongly opposed this and subsequently appealed directly to the President, primarily on the basis that at a time when the Administration had made a strong commitment to increase the supply of trained physicians, that it might be unwise to eliminate the principal program that was responsible for the teaching of the teachers. As most of you know, this commitment has subsequently been eroded, and it now seems to be the view of the Administration that with the large influx of foreign-trained physicians there is little reason to spend federal funds to increase the supply of the higher priced American product. Certainly many of us have serious concerns about the quality of some of the foreign-trained immigrants and the ultimate impact that this may have on the quality of medical care in the country, but this is an issue that has had no public debate to amount to anything. But in any event, Secretary Finch's letter to the President resulted in a somewhat uneasy truce for a period of two years after which the Office of Management and Budget proceeded to do what it had intended to do in the first place, which was to impose a policy of "no new starts"; this was manifested in

the President's budget that was announced in January 1973 and led to the phasing out of NIH research training grants and fellowships as we have known them. As most of you know, Secretary Weinberger recently announced that there would be a resumption of limited NIH research fellowship training beginning this year. The details of this, however, have not yet been fully resolved within the Department and between the Department and the Office of Management and Budget, although we continue to be hopeful that this event will take place shortly. Financial and manpower figures involved in the changes in the training and fellowship programs over the years are summarized in the figures that follow. Figure 3 shows that while the downward trend in NIH support in current dollars began with fiscal year 1970, the drop in terms of constant dollars had started two years earlier.

This brief look at the past will provide a frame of reference within which to examine the problems of the present and the future.

NIH RESEARCH TRAINING GRANTS AWARDED, FISCAL YEARS 1948-1974*

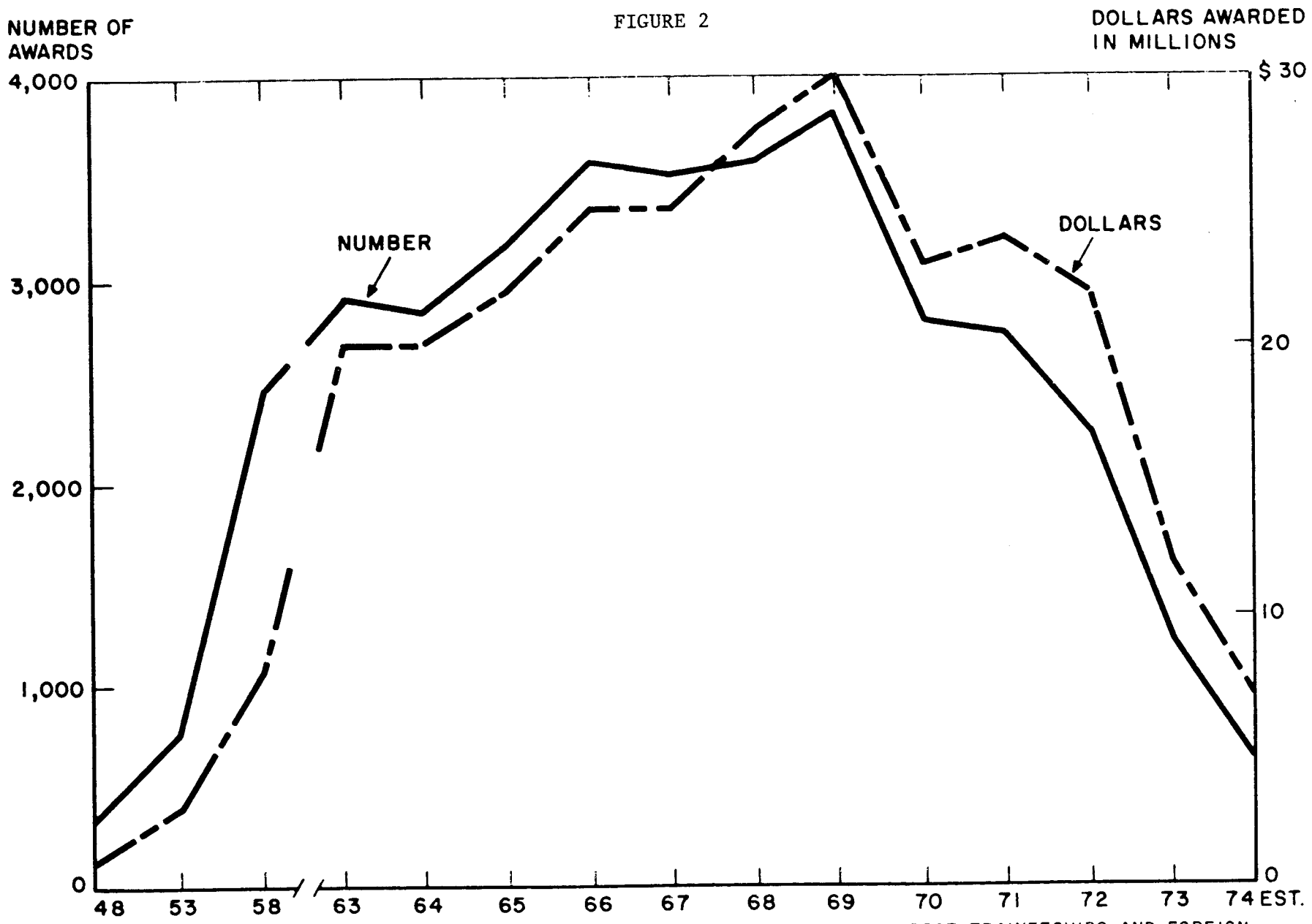
FIGURE 1



*EXCLUDES NIMH, BHME, AND NLM. INCLUDES SCIENTIFIC EVALUATION GRANTS IN ALL YEARS EXCEPT THE NUMBER OF AWARDS IN 1948 AND 1953.

NIH RESEARCH FELLOWSHIP AWARDS, FISCAL YEARS 1948-1974*

FIGURE 2

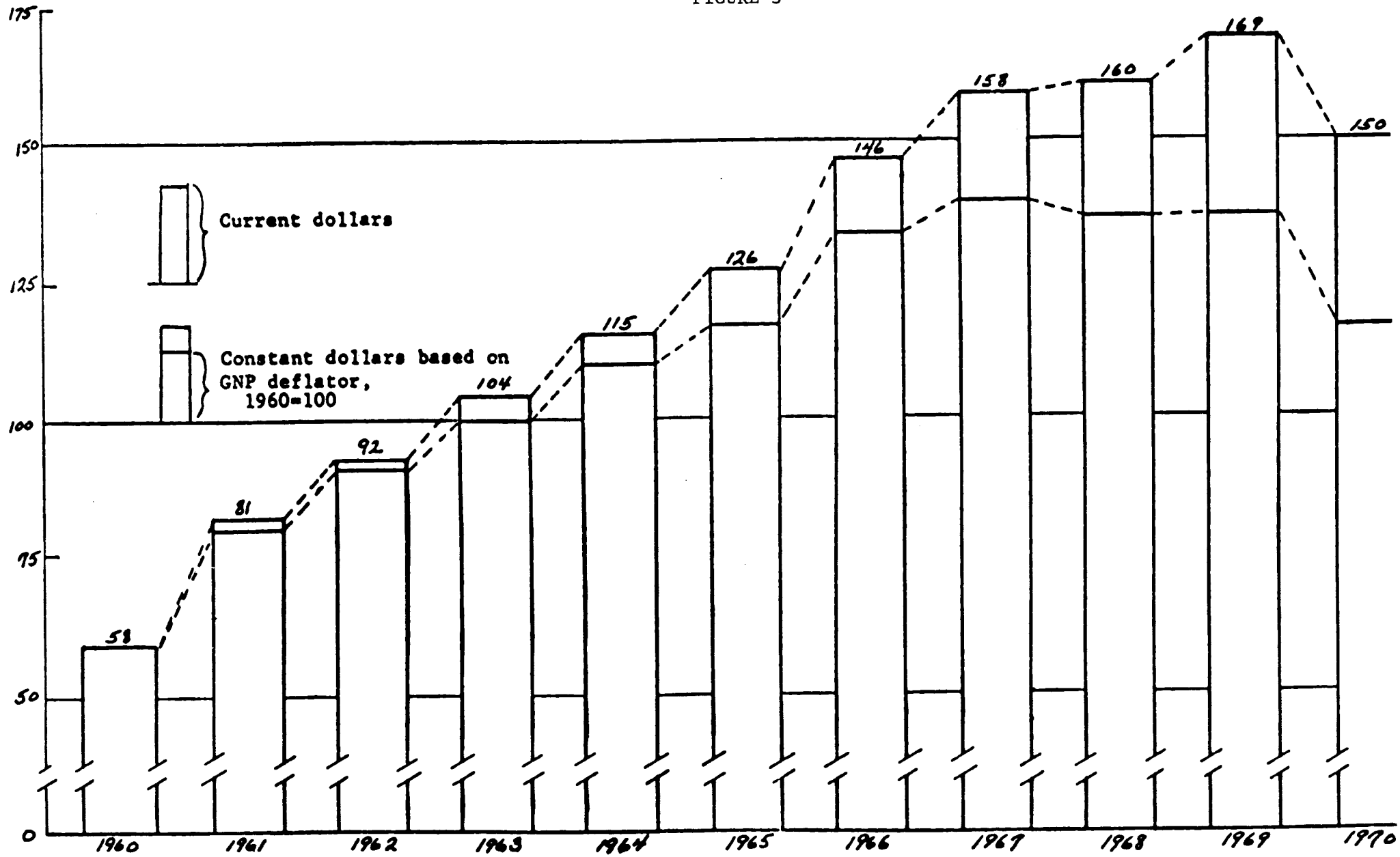


*EXCLUDES NIMH, BHME, NLM AND RESEARCH CAREER PROGRAM AWARDS. INCLUDES NINDS DIRECT TRAINEESHIPS AND FOREIGN FELLOWS.

Millions of dollars

NIH OBLIGATIONS FOR TRAINING: 1/ CURRENT AND CONSTANT DOLLARS, 1960-1970 2/

FIGURE 3



1/ Includes training grants and fellowships; excludes research career awards.

2/ Excludes NIMH.

THE NAS/NRC STUDIES OF NIGMS TRAINING PROGRAMS

*Dewitt Stetten, Jr., M.D.**

The National Institute of General Medical Sciences (NIGMS) has a particular interest in the training and fellowship programs of NIH. Approximately one third of the total expenditures on fellowships and training grants of the 10 National Institutes of Health come from the budget of the NIGMS. Substantially all of the predoctoral fellowships and training grants come from the NIGMS.

PREDOCTORAL TRAINING PROGRAM STUDY

At the request of the NIGMS, the National Research Council (NRC), through its Office of Scientific Personnel, conducted a study between 1965 and 1969 of the effects of NIGMS training programs on predoctoral graduate education in the biomedical sciences for the period 1958 to 1967. The results of that study were published in 1969 (1). The findings were favorable as indicated in the following summary of recommendations from the report (1):

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*Director, National Institute of General Medical Sciences

Although the rapidly changing character of graduate education hampered evaluation of the effects of the Graduate Research Training Grant Program on total bioscience PhD production, the program did have measurable positive impacts on the departments and on the students. The program, therefore,should be continued.

The number of students supported annually by the NIGMS training grants should be determined by the national need for high-level bioscience manpower. Until wide-ranging studies of societal need for such manpower for research, teaching, and administration can be completed, it is recommended that the results of recent studies be accepted to establish temporary manpower goals. These available studies suggest that the annual rate of bioscience doctorates should be increased-perhaps doubled-to meet future requirements.

The stipend level for pre-PhD NIGMS trainees should be increased. An initial increment of 25 percent should be made, and thereafter stipends should be related to the cost-of-living index.

A cost-of-education allowance equal at least in amount to the stipend allowance should be provided by NIGMS to be used in improving the research training capability of the department.

The present NIGMS policy of utilizing peer judgment by competent bioscientists in the selection of review and advisory committees should be continued. However, broader representation of the bioscience professional community should be sought in such consultation.

It should be possible to move students on and off training grants as local conditions demand. Any student who has been supported at any time by the training grant should be credited to the training grant program when evaluating the effectiveness of the program.

Present NIGMS policies, which (1) emphasize predoctoral training; (2) attempt to balance support between on-going programs and new programs in departments where quality can be developed; and (3) continue departmental support for new programs for a minimum of five years, are effective and should be continued.

> The NIGMS Graduate Research Training Grant Program should have among its goals that of providing an opportunity for the educationally and culturally disadvantaged to pursue careers in biomedical research. It should be recognized that such students may require more support than currently enrolled students. Such programs should be evaluated carefully to see that they have attained their stated objectives, making allowances for the beginning level of the students.
>
> Periodic evaluation of the NIGMS training program is desirable. Future evaluation would require the continued collection of data describing the various aspects of the program, including quality aspects, as objectively as possible. However, there will continue to be a need for expert subjective evaluation of these programs.

To give you some idea of these programs in their peak years, around 1967-69, the NIGMS operated 750 training grants which supported 7,700 trainees and supported 1,100 fellows of different types for a total of almost 9,000 individuals.

POSTDOCTORAL TRAINING PROGRAM STUDY

The second study for NIGMS was undertaken by the National Academy of Sciences of the NRC and was to concentrate on the effects of postdoctoral training grants and fellowships supported by NIGMS since 1958 on the careers of those so sponsored, whereas the earlier effort had been directed to the institutional effects of training grants.

The report of this study appeared in June (2).

The membership of the Advisory Committee on the Study of NIGMS Postdoctoral Fellowships and Traineeships in the Biomedical Sciences at the conclusion of the study was:

Jerome W. Conn, University of Michigan
John A. D. Cooper, Association of American Medical Colleges
Richard B. Curtis, St. George Homes, Berkeley, California
Warren O. Hagstrom, University of Wisconsin
Robert W. Hodge, University of California, Los Angeles
Leon O. Jacobson, University of Chicago (Chairman)
Percy L. Julian, Julian Research Institute
Boris Magasanik, Massachusetts Institute of Technology

The highlights of the report are succinctly stated in the introduction to the report as follows (2):

> During the 1958-1970 period, 8,685 postdoctorals, equally divided between MD's and PhD's, were supported by the NIGMS at a total cost of $86.5 million. The purpose of the study reported here was a review and evaluation of the career impacts of this program of postdoctoral support.
>
> Directors of the nation's leading biomedical research laboratories, the postdoctorals now in training there, and former NIGMS postdoctorals presented strong testimony to the effect that training at this level is essential to the continued improvement of medical science and the delivery of advanced techniques for the diagnosis, care, and treatment of disease.
>
> The study indicates that the objectives of the postdoctoral research training - to increase both the number and competence of biomedical researchers - have been met by those supported, as shown by the following data:
>
> Both post-MD's and post-PhD's are found on follow-up to be employed by the nation's medical schools in numbers far beyond those of MD's and PhD's without such training, and have advanced faster up the academic ladder than have comparable groups without postdoctoral training.
>
> Post-MD's and post-PhD's are much more frequently employed by the more research-oriented medical schools than by those less research oriented, and in much greater proportion than are PhD's and MD's without postdoctoral training.

A larger proportion of physicians who have postdoctoral training (as compared with those who do not have such training) publish articles in the scientific literature. Those postdoctorals who do publish, do so more frequently than do those without postdoctoral training, and are far more frequently cited by other scientists. This difference increases as the stage of professional career advances.

Physicians with postdoctoral training win competitive research awards with a frequency several times that of physicians from the same graduation cohorts who do not have postdoctoral training.

PhD's with postdoctoral training are more frequently employed by academic institutions, particularly those with the most prestigious graduate schools, than are non-postdoctoral PhD's, and are much more frequently engaged in research as a primary work activity.

PhD's with postdoctoral training advance to the status of thesis adviser more rapidly and in larger numbers than do PhD's without postdoctoral training.

PhD's with postdoctoral training win competitive research grants much more frequently than do those without postdoctoral training, and the difference increases as careers mature.

Postdoctoral PhD's publish more and are cited far more in the scientific literature than are non-postdoctoral PhD's, and these differences persist, with lowered intensity, when controls are introduced for ability, graduate school environment, place of employment, and major work activity.

The report contains extensive tabular and statistical information and is derived in part from direct interviews, correspondence, and site visits with mentors and with current postdoctoral and former postdoctoral students. It stresses a number of things which are often overlooked, such as the mutual benefit to both the MD and the PhD when they share a research experience in a common department or in a common laboratory, a finding which was

brought repeatedly to the attention of the committee members. Furthermore, the research training, it was pointed out, assists in the preparation of the candidate for a teaching career as well as for a research career.

Five criteria were utilized to secure quantitative data. They were: (a) engagement in research as a primary activity, (b) employment by medical schools and graduate schools, particularly those with research orientation, (c) academic advancement in these institutions, (d) winning of competitive awards of NIH and NSF research grants, and (e) contributing to the advancement of science as measured by publications in the scientific literature and, particularly, by citations of one's publications by other scientists. The limitations of these criterion measures vary. Nonetheless, they are moderately useful, and it was appropriate that they should be employed. In defense of the NAS, it should be emphasized that these indices were all specified in a document characteristic of NIH called the "Workscope" which is a part of the contracting process. These were the things NIGMS asked the NAS to do, and these were the things that were done.

SUMMARY AND COMMENT

In summary, then, the post-MDs excelled over the control group in all criteria. The control group were the contemporary physicians graduated from the same medical schools. The post-PhDs differ from PhDs

who did not have postdoctoral training in career goals. They excelled over the controls in all characteristics. However, there was one control which was slightly disturbing; namely, the NSF fellows and the Air Force Office of Science and Research fellows, who were subsidiary controls for NIGMS fellows, attained the rank of thesis adviser somewhat earlier than the NIGMS fellows. This may be a significant finding if one recognizes that the number of NSF fellows and Air Force Office of Science and Research fellows was significantly less than the number of fellows supported by the NIGMS. It is suggested that the process actually being observed is in large part the process of selection of fellows rather than their fortification by NIGMS funds.

From my own personal evaluation of the report it seemed almost devoid of criticism. It failed to note and to evaluate the element of candidate selection in the careers of those who were supported for postdoctoral training. Each of you in the institutions that do such training carefully screen and select candidates, and I assume that in many instances you bestow the training funds at your disposal upon those whom you regard as most promising. Only about 30 percent of the candidates for PhD, for instance, in the United States in the basic medical sciences receive NIGMS support. Seventy percent of them must be funded in other ways, either out of their own pockets or out of other funds which are available to the departments. I should assume that if NIGMS funds are no longer available you will be selective with such funds and, once again, it will be the best candidates who are most likely to receive support. Therefore, it may be presumptuous for

NIGMS to conclude that these people have succeeded because of NIGMS support.

Certain, very clear weaknesses in the postdoctoral training program are evident. Thus, I have heard several references to the fact that the research training programs of NIH were in some instances abused and were used (a) chiefly to strengthen departments, and (b) chiefly to support clinical rather than research training. I think of the latter charge, NIGMS, happily, is fairly innocent since it has specialized in the basic science departments. Therefore, NAS fails to note another focus of criticism, particularly of recent years, directed against the NIGMS training program, namely the size of the stipend. In the past the predoctoral stipend has been $2,400 with annual increases and dependent's allowance. The postdoctoral starts at $6,000 at a time when the contemporaries of these postdoctorals are commanding salaries of close to $10,000 in internships. This has been the subject of complaint and criticism. It has not been resolved and is apparently a defect in the program.

Perhaps most important, the report totally fails to recognize or to respond to the questions such as those that have been raised by the Office of Management and Budget and others: How do we justify subsidizing of biomedical research training and not all other kinds of research training? How do we justify subsidizing the training of an individual who, at the end of his training, may expect to command a substantial salary, perhaps not great affluence but probably more than the wage of the average taxpayer who is bearing the brunt? How do we

justify subsidizing the training of individuals who will practice the craft of biomedical research at a time when we admit that we do not have enough money to support all of the approved research grant applications from the already ambient population of biomedical researchers? I do not mention these questions frivolously; they are very troublesome and difficult questions. I suspect they can all be answered, but I for one am not quite sure how.

Then the last weakness of the report, which perhaps was nobody's fault, was that it was published in June of 1973, and, as you have just heard, it was in January 1973 that the ax fell. Therefore, this program in a sense meets the military characterization of too little, and regrettably, too late.

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THE NAS/NRC STUDIES OF NIH TRAINING PROGRAMS

*Paul D. Saltman, Ph.D.**

A little over a year ago I found myself "fingered" by the National Academy of Sciences to chair a committee to study training grant programs. About one month after I agreed to serve we learned that we were studying the greatness of training grants at a time when they were no longer extant. Nonetheless, this happy band of economists, social scientists, NIH staff, and some academicians--both MDs and PhDs--gathered to calibrate and evaluate the efficacy and viability of the training grants.

COMMITTEE DELIBERATIONS

Our efforts seemed futile at the time. On the other hand we were convinced that perhaps someday, with some other great leader of our country and some other national priorities, training grants might be reinstituted, and we wanted to be prepared. We asked ourselves: Should we do the same things we did before, or should training be handled differently? Could we learn from what had been done before how things should be carried out differently so that the next time

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*Vice Chancellor, Academic Affairs, University of California, San Diego

around it would be better?

A series of meetings were held, and we went through the standard sort of numerical analyses that you heard about from Dr. Stetten, trying to massage the numbers that roll off various computer tapes to answer such questions as who was trained, in what fields they were trained, where they were trained, and how good they are, comparing those who had fellowships with those who had none, against the criteria Dr. Stetten enumerated. From that kind of numerical massaging one can derive some sort of indication as to the quality of the people who are educated and their role in the delivery of health care and research at the present time. However, the more we began to brood about these computer tapes, the more we felt that there were other dimensions to the problem that needed a critical examination. Let me just cite some of those.

We began to believe that we ought to be able to say something about the relationship of training grants to the delivery of health care. For example, has health care delivery been improved by the existence of training programs? Is it possible that the investment in some areas of clinical education and research has made our health better? If so, how can we manifest those results? Or, do we see that fundamental research on enzymes ultimately bears fruit somehow in clinical diagnosis or treatment?

Another area we felt ought to be examined was the effect of training grants on the quality of medical education. Is it true that training grants have measurably improved the quality of education in

our teaching laboratories, in our lecture rooms, and on the wards? Each one of us has an opinion on this point, but could we show it in an institution, and if so, how? What are the effects, for example, within an institution of one department's having a training grant? Does it have a catalytic effect on other departments, and can we measure this?

Many of you have lived through situations in which money given to a department or to a program had enormous impact in elevating the level of teaching and research activity, sensitivity, quality, etc. Can we document this? What is the effect, for example, of training grants in the medical sciences on other elements within the institution itself? What is the impact on undergraduate education? Does it play a role there? If so, is that another important parameter, or are we going to be limited to looking specifically at proctologists and what the effect on proctology is by having the training grant in proctology? I think that is a narrow view. Shouldn't we look more broadly?

The economist on our committee is critical of our ignorance of market forces. He raises such questions as: Should we ask students or postdoctorals to take out a loan because of increased earnings derived from years of increased training? He also asks: Should we influence the manpower flow by rewarding them with respect to the field of endeavor into which they are seduced?

It was fascinating to see the restoration of about $30 million of direct fellowship support returned to training grants. It seems that it is part of that endless repetitive wave. We began there, didn't we? Historically, we began with the award of individual fellowships on the

basis of competition. Are we going to repeat the same mistakes we made before, or are we going to take a new look at what is the best way for the Federal Government to return into the area of research training? How are we going to train research scientists more effectively? These are the questions. Many remain unanswered.

FUTURE PLANS

At this point, our committee has developed a research plan involving matching individual trainees with other files of data which will provide information regarding career pathways and outcomes. For example, we can match the lists of trainees with the AAMC Faculty Roster and thus determine how many trainees are currently members of medical school faculties. Secondly, we are planning to visit various training institutions to try to evaluate the impact of training on the institution itself. Lastly, we have begun to develop an analysis of the economic factors involved in graduate education leading to the Ph.D. degree in the biomedical sciences.

CURRENT STATUS OF THE NIH/NIMH RESEARCH TRAINING PROGRAM

*Robert S. Stone, M.D.**

Attempting to describe the current status of and prospects for biomedical research training programs supported by NIH calls to mind a principle from another scientific discipline.

The Heisenberg Uncertainty Principle states that it is impossible to specify simultaneously both the position and momentum of a particle with full accuracy. The Principle applies in spades to the assignment you have given me. Let me state the elements of the problem:

1. We are in the process of phasing out the traditional NIH research training program whose history Dr. Stephenson has recounted.

2. We are in the final stages of developing administrative guidelines for the new research manpower training program which Secretary Weinberger announced last July. In this particular context, we are once again in the uncomfortable but familiar position of finding it difficult to acquire reliable data on shortages and other problems which the program is designed to alleviate and to fashion the best operating format.

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*Director, National Institutes of Health

3. We are also in the process of making a formal justification for the spending plan for the new program to the Office of Management and Budget (OMB).

4. The Congress is considering legislation which would replace existing NIH and NIMH training and fellowship authorities with new provisions for research training.

5. This is happening while NIH is well into its second year without a regular appropriation--the continuing resolution continues. Besides that, there is debate between the Congress and the Administration as to what an appropriation means anyway. Without embellishing the problem, I must also mention that since I accepted the invitation to speak here on research training, the brief remarriage between NIH and NIMH was annulled, and I am no longer an official spokesman for the Mental Health Institute.

Now, having laid a firm foundation for my status report, I will proceed.

THE NEW PROGRAM

To get a feel of the policy background behind the new program, it is useful to go back to the President's 1974 Budget Message which was given to Congress last January. He announced then that research training support from NIH would be phased out over a four-year period. With relatively stabilized research budgets he expressed his view that the federal role in the support of massive increases in research man-

power has been fulfilled and that a continued federal push to train researchers might well lead to an oversupply of scientists with attendant unemployment problems. The President also observed that the income expectations of doctoral-level scientists are high enough to make it appropriate for them to bear the costs of their own training.

Not long after the President announced the gradual termination of these research training programs, top Administration officials stated their willingness to consider for remedial action any special problems that might be created by the phase out. Problems were presented for consideration, and on July 9, Secretary Weinberger announced a new postdoctoral research fellowship and training program.

The new program is designed to move upward to a $90 million annual level in three years in steps of $30 million per year. Emphasis of the new program is on individual fellowships and on areas of predicted manpower shortages, with provision for payback for those trainees who do not spend an appropriate length of time in research and teaching after completing their training.

Two points made in the President's budget message emerge clearly in the specifications for the new program. They relate to caution against over-supply and to financial responsibility of the trainee. The focus of the research fellowship and training programs on shortage areas is the complement of the President's reservations about over-supply.

The payback provision is an extension of the budget message thesis that the income expectations of doctoral-level scientists make it

appropriate for them to bear their own training costs. There is, however, recognition that teaching and research salaries are not likely to equal income from clinical practice, and the payback requirement is waived accordingly.

The Secretary stressed an additional point in announcing the new program. He voiced his determination that the bulk of the new funds should go to the research trainees themselves and that less from this particular program be directed to institutional and general faculty support. Thus, the program will tilt sharply toward fellowships.

It obviously is not yet possible to announce the detailed guidelines of the new program, but from the Secretary's announcement and subsequent discussions, certain conclusions seem reasonably predictable. I will state them--with a reminder of Heisenberg's Principle:

-- Only postdoctoral research and academic training will be funded by the program, so that it will be limited to individuals holding a professional or academic doctoral degree.

-- Applicants must apply in one of the research discipline areas to be specified by NIH, and proposed study must result in research training in the specified areas.

Research training support under the program may not be used for internships, residency, or other exclusively clinical training.

Under the Individual Research Fellowship Program, awards will be made to individual applicants for specified training on the basis of national competition. Prior to formal application an applicant must arrange for acceptance by a sponsor who will supervise his training at an appropriate institution.

Fellowships in this program are not to be awarded for study leading to professional doctoral degrees.

In certain shortage areas or in case of interdisciplinary training programs, grants may be made to institutions for approved research fellowship projects. The institutional director of the research fellowship project grant would be responsible for selection and appointment of Fellows and direction of the program. Criteria for selection would be the same as for individual fellows.

Awards in either of the programs may be made for one, two, or three years.

Following their period of training, the recipients of fellowship stipends would be expected to engage in research or teaching careers in research areas defined by NIH. Individuals who go into the practice of clinical medicine or non health-related research may be required to reimburse the Government, but the payback provisions have not been worked out. New legislation may be required for this part of the program.

Stipends for the individual research fellows would be at the base rate of $10,000 per year for the first year beyond the academic or professional doctoral degree. Additional relevant experience would be recognized with an increment. This also has not yet been fully worked out.

The training institution would be provided an allowance of $3,000 to help defray the expenses of each research fellow--his supplies and equipment and in lieu of all tuition fees and deposits which are charged

need for biomedical research personnel by the National Academy of Sciences.

The Senate proposal, which differs from the original House bill, consolidates existing research and training authorities into a single National Research Service Awards Authority. The Authority is added to the Public Health Service Act and empowers the Secretary of HEW to provide through the Directors of NIH and NIMH, awards for research training at the Institutes and at public and nonprofit private institutions.

The awards may not be used to support residency training. Trainees must be sponsored by an accredited institution, but the applications for award are to be approved at the national level and are subject to review and approval by the appropriate National Institute Advisory Council.

The bill has payback provisions with credit (a) for research and teaching activities at accredited institutions and (b) for service in the National Health Service Corps, in prepaid group practice, and in designated specialties in private practice.

The bill also calls for ongoing studies annually on national need for health research manpower, on shortages by subject area, and on the kinds of training needed. Awards will be granted in any specialty only when the studies indicate need for such training.

Running through the various proposals and plans for research training are some common threads:

other students of similar status.

Stipends for fellows on institutional fellowship grant projects would be the same as for individual fellows.

An institutional allowance would be provided under the institutional project grants as well as a limited overhead allowance.

About a week ago we finished a series of hearings within NIH at which each Institute and Research Division made a detailed presentation of need for research training in its area of responsibility. These hearings gave us material to be used for justification of our spending plan which will be submitted to OMB with a request for release of the funds to set the new programs in motion. The hearings also gave us useful background information that will help make the difficult judgments as to the areas of emphasis--of anticipated shortages. These data, however imprecise, will influence our later decisions on the individual applications and help determine the mix of individual and institutional fellowships.

VARIOUS LEGISLATIVE PROPOSALS

Research training is also a principal subject of a bill now in conference between the House and Senate.

The Senate version of H.R. 7724, the "National Research Service Awards and Protection of Human Subjects Act," authorizes almost $208 million for 1974 to replace the existing NIH and NIMH training and fellowship authorities and would provide for a study of the Nation's

1. A recognition that such training will be needed, at least in certain specific subject areas;

2. An effort to identify areas of current or future shortages;

3. Prohibition of the use of the awards for postgraduate clinical (residency) training as such;

4. Financial inducement for the trainees to stay in research or teaching; and

5. An emphasis on centralized national selection of trainees.

While the Senate version of the bill has no specific provision for the institutionally administered grant, the committee report implies that provision be made for at least a part of the program to be operated on this basis.

COMPLICATIONS WHICH EVOLVE FROM ALLOWING THE FEDERAL GOVERNMENT TO ASSUME PRIMARY RESPONSIBILITY FOR DETERMINATION OF MANPOWER REQUIREMENTS

*Carl D. Douglass, Ph.D.**

I will outline some of the difficulties which might arise both in the Nation's academic and research enterprise, as well as in the lives of individual scientists, from too much and too specific federal influence on the determination of specialized research manpower needs. This, of course, is based on the assumption that needs can be validly identified and specified objectively in quantitative and qualitative terms.

The primary difficulties seem to stem from three factors: (a) the very magnitude and diversity of the Nation's medical research effort as evidenced by the multitude of agencies and organizations which support it and the variety of institutional forms which perform it; (b) the lack of mission congruence between government agencies such as NIH and the institutions which make up the academic and research communities; and (c) the perturbations induced in the balance of supply and demand of trained manpower of a particular type caused by abrupt changes in program. This third factor might be viewed by some as the capriciousness of government. In the view of others it represents

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government's interpretation and implementation of the public will. In what follows I will confine my remarks to the mission and programs of the NIH.

The basic mission of NIH is to develop through research the new knowledge required to improve and sustain human health. The relationships between NIH and the medical schools are today not as easy as they once were, and I think this is due in large part to the heightened awareness and increased attention in government quarters to interpreting the NIH mission in more strict and narrow terms than previously was the case. This has been the result of tighter budgets and the introduction of new management systems by government.

SOURCES OF SUPPORT & DIFFERING MISSIONS

Let me now address the complexity and size of the medical research effort in this country today. This consideration is not unique to a federal role in the specification of manpower needs but would plague any organization undertaking the responsibility.

The NIH is not the only organization which pursues the medical research mission. State, local, and federal governments support about two thirds of the research done in the country. Slightly less than one third is supported by industry and the remainder by private sources. Total support for medical research and development for 1973 (estimated) will total $3,540 million. A total of $2,309 million is from government support, $1,010 million from industry, and $221 million from private

nonprofit sources. The breakdown of federal sources of support for medical research and development obligations for fiscal year 1973 (estimated) is shown in Table 1. The NIH supports about 59 percent. Thus on the basis of this information, that part of the total national effort in medical research to which the NIH could reasonably lay claim for responsibility is about 37 percent. Assuming a direct proportionality between research support and the manpower requirement for that research and if the NIH mission, strictly interpreted, is to support the development of research manpower to further its own interests, a sizeable responsibility gap for production of the balance is at once apparent. On the other hand, we must also recognize that the Nation's educational institutions also bear a responsibility for providing trained manpower for the country's entire medical research enterprise.

The situation is further complicated because institutional performance of medical research is not distributed in accordance with its support. This is summarized in Table 2 in which it is estimated that medical schools make up about 67 percent of the higher education component. Our Nation's medical research enterprise is extraordinarily complex, and any one organization or agency which would presume to enunciate the manpower requirements for it in its entirety would require data far in excess of that available today. Some of this information would be very expensive and difficult to obtain, and much of it from the private sector would be unavailable and properly so.

The second source of difficulty relates to missions. When compared with the mission of an academic medical center, the NIH mission

TABLE 1

Federal Sources of Support for
Medical Research and Development

Obligations FY 1973 (Est.)

Source	Amount (Millions)	
Dept. of Health, Educ., & Welfare	$ 1,611.8	
(National Institutes of Health)		(1,312.3)
(HSMHA)		(224.4)
(Other PHS)		(37.4)
(Other DHEW)		(37.7)
Dept. of Defense	144.3	
Atomic Energy Commission	108.8	
Nat. Aeronautics & Space Admin.	64.1	
Veterans Administration	73.2	
Dept. of Agriculture	69.0	
Dept. of Transportation	42.0	
National Science Foundation	39.5	
Dept. of Interior	33.2	
Dept. of State	14.2	
Environmental Protection Agency	20.9	
Dept. of Commerce	4.5	
Tennessee Valley Authority	3.2	
Total Federal	$2,228.5	

is quite narrow. The academic medical center is responsible for the education of a considerable variety of health professional personnel, for health care delivery in a number of modes, and for a number of other purposes such as demonstration, education, innovation, as well as research. Nonetheless, the medical schools represent the most important component of NIH's institutional clientele.

NIH research grant funds for FY 1973 are estimated to total $940 million, of which medical schools will receive $479 million or over one

TABLE 2

Medical Research and Development (USA)

FY 1973 (Est.)

	By Source of Support		By Performer		
	Amount (Millions)	Rank Order	Amount (Millions)	Rank Order	
Private Nonprofit	$ 221	(3)	$ 1,714	(1)	
(Higher Ed.)					(1,184)
(Other)					(530)
Industry	1,010	(2)	1,195	(2)	
Government	2,309	(1)	631	(3)	
Total	$3,540		$3,540		

half. This has been the case for several years. All other institutional forms (other health professional schools, universities, hospitals, research institutes, health departments, etc.) received about 48.4 percent.

In today's governmental setting, any assessment of manpower needs by NIH or any other governmental agency will of necessity reflect its view of reality as seen through the filter of its mission. In the development of the new research manpower program, I trust the NIH will be permitted to take into account the needs of the medical schools for faculty since about one half of all its research grant dollars are in the hands of the faculty.

PERCEIVED SOCIETAL NEEDS

The remaining factor which is a major source of difficulty is the oscillations induced in the supply of a particular type of trained manpower by the entry of individuals into the training pipeline in response to recognized societal needs on the one hand, and the rapid withdrawal of support because of a perception that the need has been met on the other. This is the inevitable response of a government agency to the public will as expressed through directives from the legislative and executive branches of government. To illustrate, when the birthrate soared in the period 1947 through 1958, there was a panic about the shortage of elementary and secondary school teachers. Individuals were provided with encouragement by government to enter teacher training with the result that large numbers of students made individual career decisions to become teachers. Unfortunately, when the birthrate reversed its course and started downward in 1961, individuals making the career choices did not receive the signals that would have discouraged their entry into that particular pipeline at the appropriate time. The result has been a serious surplus of teachers. There will always be a need for steady state level of production of teachers even at zero population growth rate. The signals to increase the rate of production of a particular type of manpower seem always to come too late to avoid shortages and the signals to decrease the rate of production too late to avoid surpluses. The challenge is to find ways to dampen the oscillations.

The period of rapid growth of NIH research appropriations of the late 50s and early 60s constituted a signal to increase the rate of production of research manpower. The problems which bring us here today are related to the disagreement as to the interpretation of a fairly level research appropriation as a signal to continue that rate or to decrease it.

I think the government will always be in the position of responding in somewhat exaggerated ways to perceived societal needs. It may be that these oscillations can be dampened by the participation of groups such as the AAMC and others with vital interests. The government agencies' optimal role would be to issue broad and long-range forecasts. This presupposes that it can so act. It will inevitably be the instrument of the public will, however, and if that will decrees a rapid build-up of research in a particular area or the abrupt termination of research in another, there is not much to do but respond accordingly. Anything more specific in terms of numbers or descriptions of fields of specialization will require the inputs of information and active participation of all who have a stake in it as either producers or users of the research-trained manpower.

AHA ESTABLISHED INVESTIGATOR PROGRAM: AN EXAMPLE OF A NONFEDERAL MODEL

*Roland E. Schneckloth, M.D.**

For many years the American Heart Association has viewed research training as being divided into two phases. The first phase provides primary training to young men and women indicating interest in and, in the eyes of their preceptors, having potential for research careers. Support for Phase One training is ordinarily of two types, the first of which would be institutional and the second in the form of a research fellowship or traineeship. We feel that an attrition rate of at least 25 percent due to shifting into fields other than research must be accepted at this stage of training, because it is impossible to judge a candidate's potential for research accurately before he has been exposed to a research environment. Some will find they do not have talent for research or will be so advised by their preceptors. Others will decide that they cannot accept the economic sacrifice associated with a career in research and will elect to leave the training program for practice. This primary screening is absolutely essential, however, if high quality trainees are to be identified for entrance into Phase

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Two training.

Phase Two research training is visualized as being similar to the Established Investigatorship program of the American Heart Association. This award provides an unencumbered five-year period of stipend support in which the young, especially talented investigator is freed of most obligations in teaching or service. This Phase Two training is considered to be the most important stage in the training process and one in which the investigator becomes highly productive while completing his training. Indeed, the name of the program is perhaps somewhat of a misnomer. Some have suggested that "Establishing" Investigator, rather than "Established" Investigator, should be the title of the award.

HISTORICAL BACKGROUND

The first Established Investigatorship awards were made 24 years ago, antedating the NIH Career Development Research Award program by 12 years. The program has been in continuous existence since that time.

The Established Investigatorship Program was formulated at the first meeting of the Association's Research Committee in October 1948--almost 25 years ago. Louis Katz was chairman, and other members included Howard Burchell, Harry Goldblatt, Howard Sprague, Eugene Stead, Lewis Thomas, Francis Wood, and Harland Wood. They laid down five fundamental precepts which have defined the Established Investigatorship Program ever since. These principles were:

1. To solve the enigmas posed by a series of major cardiovascular diseases of unknown cause, it is essential to concentrate a substantial portion of our financial resources on basic research.

2. Solving these problems requires finding the best possible research minds to attack them.

3. The Association's research program must focus, therefore, not on specific research projects, but on the individual.

4. Scientific merit must be the primary consideration in the allocation of funds without regard to category of research or geography.

5. Investigators must be given complete intellectual freedom in the pursuit of their research goals.

The basic qualifications for an award were: (a) postdoctoral degree; (b) U.S. citizenship or permanent resident visa; (c) usually 3 or more years of postdoctoral research experience at the time of application; (d) ordinarily under age 40 at the time of application; (e) evidence of ability to conduct independent research; and (f) expenditure of 75 percent or more of professional time on research, under the general supervision of a preceptor or sponsor.

In January 1949 a few months after this planning meeting, the committee made the first two awards to Dr. Russell Elkinton and Dr. Wilfried Mommaerts. The next group of awards were made to Alfred Fishman, John Gergely, John Merrill, Robert E. Olson, Chandler Stetson, and Louis Tobian. These names will illustrate the type of individual they were looking for.

A word at this point about the selection process. After receipt of an application, each candidate is interviewed by either a member of

the selection committee or a recent past member of the committee. The candidate travels to the interviewer's institution for the interview where he is also interviewed by a colleague of the committee member. The applicant also is frequently asked to present his work at a research seminar or to groups of graduate or undergraduate students at the interviewer's institution. Written interview reports become an integral part of the application which is then reviewed in the usual peer review process. Applications are received once a year on July 1, and notification of action sent out in October, nine months before activation dates.

During their award, the activities of awardees are monitored very slightly except for annual progress reports. Institutional transfers are permitted, and awardees are encouraged to spend portions of their five-year award in other laboratories in this country or abroad. Travel and cost-of-living supplements are provided for this purpose. During the fourth year of the award awardees are interviewed again to determine if there are termination problems at the end of the five-year period. Such seldom occur, and most individuals obtain tenure appointments. Brief extensions of the award are permitted only rarely and never exceed 6-12 months.

EI PROGRAM DATA

The total number of applicants applying to this program over the past 25 years (1949-1974) is 1,111. A total of 433 awards have been made

(a 38 percent approval rate), and 123 individuals are now in the program. There are 310 past awardees, four of whom have died. Since the oldest awardees are only now in their early 60s, there has been no attrition from retirement. During the late 50s and through 1968 an average of 45 applications was received annually. A rather marked rise to 82 applications occurred in 1969, followed by a peculiar fall the subsequent year with a rise to 87 applications in 1971 and 1972, 111 in 73, and 135 for 1974. , Recent applicants have had a median age of approximately 33 years, ranging from the late 20s through the early 40s. The age of awardees has been about the same as applicants. Early in the program a majority of applicants and awardees were MDs, but the percentage of Ph.D. candidates has increased in recent years, this year to a rather striking 68 percent.

Prior postdoctoral research training support of applicants to the Established Investigator Program for the five-year period, 1970-1974, is summarized in Table 1. A majority (53 percent) of those with fellowships or traineeships obtained such support through federal (mostly NIH) programs. The actual percent is probably larger since 12 percent of applicants did not identify the source of such training support. The principal areas of research training of applicants over the past three years are shown in Table 2. In an attempt to determine the effect this award has had in molding the careers of individuals who have graduated from the program since its inception in 1949,the Heart Association has studied the present positions of past awardees. As seen in Table 3, almost 92 percent continue to work in academic set-

TABLE 1

Prior Postdoctoral Research Training Support
of EI Applicants 1970-1974

Year	All Applicants	Prior Fellowships or Traineeships	
1970	59	52	88%
1971	87	69	79
1972	87	68	78
1973	111	86	77
1974	132	92	70
Total	476	367	77%

tings, with 83.4 percent in medical schools or universities and 8.5 percent in research institutes. The attrition rate due to shifting into fields other than academic medicine and biology is really quite small: 8.1 percent,and 4 of the 12 in private practice hold clinical professorial appointments. Only 5 percent of awardees are at the associate professor level at entry into the program; the rest are at the assistant professor or research associate level.

With respect to professional activities of those past investigators in academic medicine, five years after graduation from the program they continue to spend some 55 percent of their time in research, 20 percent of their time in teaching, and about 15 percent of their time in administration or clinical practice. Ten years after their award, when most are in their mid-forties, they spend approximately

TABLE 2

Principal Area of Research Training
Established Investigator Applicants and Awardees
1971-1973

Area of Training	Applicants #	Applicants %	Awardees #	Awardees %
Biochemistry	74	26.0	26	32.5
Physiology	65	22.8	17	21.3
Internal medicine	27	9.5	3	3.8
Pharmacology	22	7.7	7	8.7
Immunology	17	6.0	6	7.5
Pathology	10	3.5	-	-
Surgery	8	2.8	6	7.5
Developmental biology	8	2.8	3	3.8
Biophysics	8	2.8	2	2.5
Chemistry	7	2.5	-	-
Endocrinology & metabolism	6	2.1	2	2.5
Bioengineering	5	1.8	1	1.2
Hematology	5	1.8	-	-
Cellular biology	4	1.4	3	3.8
Molecular biology	4	1.4	2	2.5
Microbiology	4	1.4	1	1.2
Neurology	4	1.4	-	-
Biometrics, biostatistics	2	0.7	-	-
Pediatrics	2	0.7	-	-
Anatomy	1	0.3	1	1.2
Epidemiology	1	0.3	-	-
Psychology	1	0.3	-	-
Total	285	100.0	80	100.0

45 percent of their time in research, 20 percent in teaching, 10 percent in practice, and 25 percent in administration.

Alumni of the program would appear to have an important impact on research and teaching in medical centers and institutions throughout the country. For example, they are training a new generation of re-

TABLE 3

Present Positions of Past Established Investigators

Present Positions	Past EI's			
A. Medical Schools and/or Universities			255	83.4%
Deans	3	1.0%		
Associate Deans	3	1.0		
Department Chairmen	28	9.2		
Professors	139	45.4		
Associate Professors	76	24.8		
Assistant Professors	6	2.0		
B. Research Institutes			26	8.5%
Directors	5	1.6%		
Senior Scientists	18	5.9		
Staff Scientists	3	1.0		
C. Non Academic			25	8.1%
Private Practice*	12	3.9%		
Industry	5	1.6		
Scientist-Administrator	3	1.0		
Scientist-Writer	1	0.3		
Other	4	1.3		
Total			306	100.0%

*Four of the 12 hold Clinical Professor appointments.

search workers; 95 percent are engaged in undergraduate or postgraduate teaching, each investigator reaching an estimated 100 or more students each year, and eight former awardees are working in academic institutions abroad.

To measure the cost effectiveness of this program is exceedingly

difficult. Over the past 25 years, the total program cost has amounted to $25,616,000. At present the stipend is individually negotiated with the institution up to 75 percent of the awardee's income for a maximum of $25,000 per year. The average stipend in 1973 was $16,000, and the average total income of the current 123 active awardees is $24,000. One would like to be able to say that this program has had a potent effect on the career choices of the individuals involved. Testimonials from graduates of the program are almost uniformly favorable, and they evaluate the strongest part of the program to be that it permitted development as independent investigators at a critical stage in their careers. But the proof of the pudding would, I suppose, be a comparison with disapproved applicants who did not receive Phase Two training. We are now matching the disapproved applicants with those who entered the program. Unfortunately, no data are available at this time, primarily due to great difficulty in locating about one fourth of those who were disapproved.

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