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MEETING OF THE WORKING GROUP ON

MEDICAL REHABILITATION

RESEARCH TRAINING

February 4-5, 1991

Building 31, Conference Room 4
National Institutes of Health
Bethesda, Maryland

If your office needs to contact you on February 4 or February 5, the following phone numbers are available:

DAYTIME

NIH/OSPL office	(301) 496-1454
NIH/OSPL FAX number	(301) 402-0280

EVENING

Bethesda, Marriott	(301) 897-9400

DINNER RESTAURANTS

Seafood

Bish Thompson's
7935 Wisconsin Ave.
656-2400

O'Donnell's
8301 Wisconsin Ave.
656-0535

Italian

Frascati
4806 Rugby Ave.
652-9514

La Luna
4846 Cordell Ave.
654-4600

La Panatteria Ristorante Italiano
4921 Cordell Ave.
951-6433

Pines of Rome
4709 Hampden Lane
657-8775

Plaza Cafe (Mainly Italian)
Hyatt Regency Hotel
One Bethesda Metro Center
657-1234

Posetano
4940 Fairmont Ave.
654-1717

Chinese

China Coral
6900 Wisconsin Ave.
656-1203

China Taste
7800 Wisconsin Ave.
654-1700

Windows of the East
4747 Elm St.
654-6444

French

La Miche
7901 Norfolk Ave.
986-0707

Le Marmiton
4931 Cordell Ave.
986-5188

Le Vieux Logis
7925 Old Georgetown Rd.
652-6816

Central European

The Vagabond
7315 Wisconsin Ave.
654-2575

Mexican

El Caribe
8117 Woodmont Ave.
656-9588

Tia Queta
8009 Norfolk Ave.
654-4443

American

Chatter's @ Bethesda Ramada
8400 Wisconsin Ave.
656-2151

Sir Walter Raleigh Inn
8011 Woodmont Ave.
652-4244

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

National Institutes of Health
Bethesda, Maryland 20892
Building :
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(301) 496-

JAN 14 1991

NOTE TO WORKING GROUP ON MEDICAL REHABILITATION RESEARCH TRAINING

Subject: Briefing Materials

Attached for your information are the briefing materials for the February 4-5 meeting of the Working Group on Medical Rehabilitation Research Training. The meeting on February 4 will begin at 9:00 a.m., in Building 31, Conference Room 4, National Institutes of Health, Bethesda, Maryland.

In reviewing the agenda for the first day, you will note a series of presentations in the morning that highlight relevant information about a variety of research training mechanisms currently supported by the NIH as well as examples of NIH supported research training environments that have been effective in promoting multi-disciplinary research programs. Later in the morning, another perspective on this issue will be provided by three of the Working Group members who will discuss medical rehabilitation research training programs at their respective institutions.

For the afternoon deliberations on the first day and the morning deliberations on the second day, we have identified some discussion points that are intended to focus the debate leading to the development of a report by the Working Group. A science writer, Dr. Ellen Rossman, who is knowledgeable about the medical rehabilitation issue, has been assigned to work closely with the Chair and members of the Working Group in drafting the report. I anticipate that the report of the Working Group on Medical Rehabilitation Research Training will provide important guidance to the NIH and the National Institute on Child Health and Human Development in implementing P.L. 101-613, which establishes the National Center on Medical Rehabilitation Research.

Should you have any questions about the agenda or the report drafting process, please call me at 301-496-3152, or Dr. Suzanne Medgyesi-Mitschang at 301-496-1454.

I look forward to an interesting discussion of a critical issue that has important implications for ensuring continued progress in the field of rehabilitation medicine.

Jay Moskowitz, Ph.D.
Associate Director for
Science Policy and Legislation

Attachment

+ Binder of material

BACKGROUND MATERIAL FOR THE MEETING OF THE
WORKING GROUP ON MEDICAL REHABILITATION RESEARCH TRAINING

February 4-5, 1991

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AGENDA

MEETING OF THE
WORKING GROUP ON MEDICAL REHABILITATION RESEARCH TRAINING

February 4-5, 1991

Building 31, Conference Room 4
National Institutes of Health
Bethesda, Maryland

Chairman . . . . . .Dr. Marcus Fuhrer

First Day

MORNING SESSION

9:00-9:05 Opening Remarks: Mandate of the Working Group. . . . . .Dr. Jay Moskowitz

9:05-9:15 Overview: Implementation of P.L. 101-613 by the National Institute of Child Health and Human Development. . . . . .Dr. Duane Alexander

9:15-9:25 Statement by the Chairman: Meeting Procedures, Expectations, Report Drafting. . . . .Dr. Marcus Fuhrer

9:25-9:35 Questions and Answers. . . . . .Dr. Marcus Fuhrer

9:35-9:45 Summary of the Recommendations of the Panel on Basic and Clinical Research Training, Task Force on Medical Rehabilitation Research. . . .Dr. Theodore Cole

9:45-10:00 Questions and Answers/Group Discussion

Discussion Leader. . . . . .Dr. Marcus Fuhrer

10:00-10:15 NIH Research Training Mechanisms--Overview . . . . . .[NIH/OD Extramural Research Senior Staff]

10:15-10:45 Selected Examples of NIH Supported Research Training Environments (10 min. each)

National Institute on Aging. . . . . .Dr. Stanley Slater

- Claude Pepper Geriatric Research and Training Centers
- Claude Pepper Older Americans Independent Centers

National Institute of Child Health and Human Development

- Mental Retardation Centers. . . . .[NICHD Senior Staff]

National Center for Nursing Research

- Centers of Excellence in Nursing . . . . . .[NCNR Senior Staff]

10:45-11:00 **COFFEE BREAK**

11:00-11:15 **Questions and Answers/Group Discussion**

Discussion Leader. . . . . .Dr. Marcus Fuhrer

11:15-11:25 **Current Medical Rehabilitation Research Training Supported by the NIH**. . . . . .Dr. David Gray

11:25-12:25 **Examples of Medical Rehabilitation Research Training Programs Nationally** (10 min. each)

Baylor College of Medicine . . . . . .Dr. Marcus Fuhrer

Kessler Institute for Rehabilitation . . . . . .Dr. Thomas Findley

University of Michigan . . . . . .Dr. Theodore Cole

12:25-12:45 **Questions and Answers/Group Discussion**

Discussion Leader. . . . . .Dr. Marcus Fuhrer

12:45-1:30 **LUNCH** (Catered)

AFTERNOON SESSION

1:30-3:30 **GROUP DISCUSSION**

Discussion Leader. . . . . .Dr. Marcus Fuhrer

PROPOSED ITEMS FOR DISCUSSION:

- *Who should be trained by the NIH for research in medical rehabilitation?*
- *What should be the research training setting?*
- *What is the role of interdisciplinary training for research in medical rehabilitation?*

3:30-3:45 **COFFEE BREAK**

3:45-5:00 **GROUP DISCUSSION**

Discussion Leader. . . . . .Dr. Marcus Fuhrer

PROPOSED ITEMS FOR DISCUSSION:

- *What steps can the NIH take to encourage greater participation by the rehabilitation medicine research community in competing for existing research and training awards?*
- *What modifications of current NIH research training mechanisms are needed to meet the special requirements of research training in medical rehabilitation?*

  Example: Pediatric Scientist Training Program. . . . . .Dr. Duane Alexander

5:00 **ADJOURN**

Day Two

MORNING SESSION

8:30-10:30 **GROUP DISCUSSION**

Discussion Leader. . . . . .Dr. Marcus Fuhrer

PROPOSED ITEMS FOR DISCUSSION:

- *What training approaches should be considered to encourage early interest in the field of rehabilitation medicine by students in graduate schools and medical schools, as well as to attract senior investigators to the field?*
- *Given developments in the field of rehabilitation medicine and the number of active researchers in this field, what funding level is needed to support medical rehabilitation research training programs over the next five years?*

10:30-10:45 **COFFEE BREAK**

10:45-12:00 **GROUP DISCUSSION**

Discussion Leader. . . . . .Dr. Marcus Fuhrer

PROPOSED ITEM FOR DISCUSSION:

- *What high-priority training needs in rehabilitation medicine need to be addressed by existing and proposed award mechanisms?*

12:00-12:10 **Report Drafting**. . . . . .Dr. Jay Moskowitz
Dr. Marcus Fuhrer

Questions and Answers

12:10-12:15 **Closing Remarks**. . . . . .Dr. Marcus Fuhrer
Dr. Duane Alexander
Dr. Jay Moskowitz

12:15 **ADJOURN**

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WORKING GROUP ON MEDICAL REHABILITATION RESEARCH TRAINING

MANDATE

The Task Force on Medical Rehabilitation Research noted that rehabilitation medicine is an emerging scientific discipline at a "critical stage of development and opportunity." Progress in basic, clinical, and applied rehabilitation research is expected to have significant impact upon the development of medical therapies and services to ensure independence and a high quality of life for individuals with disabilities. However, the field thus far has not attracted the body of researchers necessary to achieve this impact. Furthermore, since this area of research is primarily clinically based, current training of researchers in scientific research techniques tends to be inadequate. Consequently, there is an acute need to develop a critical mass of trained researchers for this field to realize its full potential.

The general mandate of the Working Group on Medical Rehabilitation Research Training is to review multiple ways of enhancing research training in medical rehabilitation to strengthen the scientific foundation of this area of medicine. Specifically, the Working Group will:

- review and identify existing NIH training and research award mechanisms that would promote increasing opportunities for single-investigator and collaborative interdisciplinary studies in rehabilitation medicine;
- recommend steps the NIH can take to encourage greater participation by the rehabilitation medicine research community in competing for existing research and training awards;
- identify new research training programs and expand existing ones to increase the number of new and established investigators entering the field of medical rehabilitation and increase the diversity of research specialties represented in the field;
- propose training approaches to support <u>early</u> research training of students in graduate schools and medical schools related to the field of rehabilitation research;
- develop incentives to attract senior investigators in rehabilitation related disciplines to actively pursue research in medical rehabilitation; and
- emphasize high-priority training needs in the field of rehabilitation medicine to be addressed by existing and proposed award mechanisms.

NATIONAL INSTITUTES OF HEALTH (NIH)

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62ND MEETING OF THE ADVISORY COMMITTEE

TO THE DIRECTOR

+ + +

TUESDAY, DECEMBER 18, 1990

+ + +

The Committee met in Conference Room 10, Building 31, National Institutes of Health, Bethesda, Maryland at 8:00 a.m., DR. WILLIAM F. RAUB, Acting Director, NIH, presiding.

PRESENT:

GEORGE ABRAHAM, M.D.

JOHN W. CHANDLER, M.D.

JOSEPH M. DAVIE, M.D.

JANICE E. S. DOUGLAS, M.D.

JOHN W. ECKSTEIN, M.D.

ORIGINAL

PRESENT (Continued):

JoANN GLITTENBERG, Ph.D., R.N., F.A.A.N.

HELEN K. GRACE, Ph.D.

RUBY P. HEARN, Ph.D.

JANE HENNEY, M.D.

FREDERICK A. KING, Ph.D.

KARIN T. KIRCHHOFF, Ph.D., R.N.

DAVID KORN, M.D.

RONALD W. LAMONT-HAVERS, M.D.

WILLIAM D. McHUGH

JAY MOSKOWITZ, Ph.D.

RODNEY W. NICHOLS

PETER C. NOWELL, M.D.

PETER PREUSS

JOSEPH RALL

WILLIAM F. RAUB, Ph.D.

ROBERT J. RUBEN

MATTHEW D. SCHARFF, M.D.

PALMER W. TAYLOR, Ph.D.

PETER H. von HIPPEL, Ph.D.

TADATAKA YAMADA, M.D.

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P-R-O-C-E-E-D-I-N-G-S

(8:09 a.m.)

OPENING REMARKS

WILLIAM F. RAUB, PH.D.

ACTING DIRECTOR, NIH

DR. RAUB: Good morning. My name is Bill Raub. I am the Acting Director here at the NIH. It's my privilege to call to order the 62nd meeting of the Advisory Committee to the NIH Director.

We have a special welcome today for the representatives of the national advisory councils and boards who will be participating today.

Joining us are: Dr. George Abraham, representing the National Advisory Council on Aging; Dr. John W. Chandler, representing the National Advisory Eye Council; Dr. Joseph M. Davie, representing the National Advisory Council on Allergy and Infectious Diseases; Dr. Janice E. S. Douglas, representing the National Heart, Lung and Blood Advisory Council; Dr. JoAnn Glittenberg, representing the Fogarty International Center Advisory Board; Dr. John Griffith, representing the National Advisory

Child Health and Human Development Council; Dr. Jane Henney, representing the National Advisory Research Resources Council; Dr. Karin T. Kirchhoff, representing the National Advisory Council on Nursing Research; Dr. David Korn, representing the National Cancer Advisory Board; Dr. Ronald W. Lamont-Havers, representing the National Arthritis and Musculoskeletal and Skin Diseases Council; Dr. William D. McHugh, representing the National Advisory Dental Research Council; Dr. Robert J. Ruben, representing the National Deafness and Other Communication Disorders Advisory Council; Dr. Palmer W. Taylor, representing the National Advisory General Medical Sciences Council; and Dr. Tadataka Yamada, representing the National Diabetes and Digestive and Kidney Diseases Advisory Council.

Before proceeding to our principal topics for discussion today, I will report briefly on the status of activities undertaken or planned as a result of our last meeting.

STATUS REPORT ON ACTIVITIES FOLLOWING THE JUNE 1, 1990 MEETING OF THE ADVISORY COMMITTEE TO THE DIRECTOR, NIH ON REVIEW OF THE NATIONAL INSTITUTES OF HEALTH RESEARCH TRAINING PROGRAMS AND UPDATE ON STRENGTHENING THE SCIENTIFIC REVIEW PROCEDURES OF THE NIH INTRAMURAL RESEARCH PROGRAM

WILLIAM F. RAUB, PH.D.

ACTING DIRECTOR, NIH

DR. RAUB: At that meeting on June 1st, we discussed in great detail the recommendations contained in the "Report of the Task Forces for the Review of NIH Biomedical Research Training Programs." The advice you provided at that meeting weighed heavily in my decisions concerning those recommendations.

On the table in front of you, I am told, you will find a copy of a memorandum that records those decisions, provides a brief outline of a proposed implementation plan for each, notes the level of authority required for implementation, and indicates the status of action taken.

For those of you who like to keep score, also included are tallies from polls taken during the January round of meetings of the councils and boards of the institutes, centers, and divisions; at the June 1 meeting of the Advisory Council to the Director, NIH; at a June 12 meeting of the NIH Training Activities Committee, an internal group; and, last, but not least, the commentaries and views of each of our institute, center, and division directors.

In those instances where we fell short of an overwhelming consensus, which weren't many, we nevertheless found a strong rationale for our chosen course.

I am pleased to note the NIH has the authority to implement all but one of these recommendations. And we're, therefore, moving straight away to do so.

Only Recommendation Number 3, the recommendation that calls for modifications of the payback requirement for National Research Service Award training authority, will require legislative changes.

Ironically enough, this also is the one where a clear consensus eluded us and, therefore, the decision is based on some synthesis of recommendations.

As you will recall, the principal thrust of the recommendation on payback tended to be driven by concern around the postdoctoral training arena and called for a reversal of our current legislative policy with respect to payback. Now the first year can be pursued without incurring a payback obligation, and then everything thereafter builds the tally.

Our task force recommended a reversal of that, namely that a payback would be incurred during the first year of training obligation, but could be expunged by a second year of research training.

This group went a step further and recommended explicitly that what counts for that second year of expunging experience not be limited to the classical training grants, but be some other comparable research training experience if, in fact, you could properly document it.

On the other hand, some argued that the

real issue would be to eliminate the payback obligation, many perceiving it as a significant disincentive to recruitment and retention in research careers.

Absent an obvious consensus, but with two strong points of view on the table, I chose to take a piece of both. And, therefore, I'm proposing that we develop and submit to the higher levels of the Department for consideration of the legislative proposal something that will eliminate the payback requirement for all pre-doctoral trainees and fellows. I make that recommendation on the basis that payback rarely has been an issue in the pre-doctoral arena.

Viewed by many as a disincentive, it seems to me with the needs for attracting more young people into research careers, wanting to make that magnet as strong as we can, that there's no point having a disincentive that need not be there.

Anything that we can do to make sampling the research experience attractive for young people seems to me in the long-term interests of the national overall and mindful of the demographic changes that

we see coming.

On the other hand, we also tend to propose the modification of the service payback requirement will apply to postdoctoral trainees and fellows along the lines recommended by the task force; that is, to permit a one-year obligation incurred during the first year of research training to be satisfied by a second year of research training or some other health-related research or teaching activity.

And then to round this out, we will request as part of that legislative package the authorization for the NIH to collect information on the employment of former trainees and fellows in order to evaluate the success of the NIH research training programs.

Many noted that our ability to be continued effective advocates for a formal investment in research training will require better information than we traditionally have had as to what happens to the trainees. This authority would give us a clear means to develop such data.

The other status report that I have for

you this morning relates to our previous discussions about strengthening the scientific review procedures of the NIH intramural research program.

You will recall that this was the focus of our meeting on January 26th and at the subsequent meeting on June 1st, Dr. Rall presented a report then on the status of activities undertaken to implement the recommendations contained in that report.

Since then the following additional steps have been taken. Dr. Rall and I met with the chairpersons of the NIH boards of scientific counselors in September to examine the current practices regarding scientific review of intramural research.

That meeting served as a first step toward enlisting these key advisors in effecting the selected reforms recommended by the Institute of Medicine and endorsed largely by this Advisory Committee.

Second, the NIH Policy Manual was revised to contain a statement that reads as follows, "The scientific and administrative leadership of the Scientific Directors should be evaluated every four

years by the Board of Scientific Counselors. The Chairperson of the Board of Scientific Counselors should provide the ICD Director with a written evaluation of the Scientific Director, including a discussion of the overall direction of the intramural program, and the efficacy of the review process; the report should also be provided to the Deputy Director for Intramural Research and the Director, NIH."

Third, the members of Boards of Scientific Counselors and ad hoc reviewers now are to be recommended by the chairperson of the board with the advice of the scientific director.

The term of office for scientific counselors has been increased to a maximum of five years to promote greater continuity of review. A procedure has been adopted whereby no more than one-half of the reviewers at a board meeting may be ad hoc.

We think these administrative policy changes capture the spirit and the thrust of the recommendations regarding the continuity and the makeup of those boards of scientific counselors.

Fourth, reporting of the reports of reviews has been expanded to include an oral summary presented to the Scientific Director, the ICD Director, and the Deputy Director for Intramural Research prior to adjournment of the board.

A written response of the Scientific Director is distributed with the report of the board to the ICD Director, the Deputy Director for Intramural Research, and the Director, NIH.

Feedback is emphasized further by the presentation of an overview to the ICD's National Advisory Council that includes a discussion of the board's report and response of the Scientific Director.

This set of actions springs from the recommendation that we do everything we can to promote prompt closure on recommendations and playback to our advisors, both the boards of scientific counselors and the councils and boards, as to what recommendations have been made, what actions have been taken as a result of them.

In general, these two areas indicate that

we made a concerted effort in the last year and a half to bring to the Advisory Council to the Director some action-oriented agendas and to translate your recommendations into appropriate policy decisions and program initiatives.

I am particularly grateful to Drs. Rall, Diggs, and Moskowitz, who spent a considerable amount of time over the last year and a half in ensuring that this group had the information and support it needed to make informed recommendations and then in following through on those things that this Board chose to recommend.

TOPIC I--MEDICAL REHABILITATION RESEARCH

DR. RAUB: Let's move now to the first topic of discussion for today's meeting; that is, medical rehabilitation research. At the June 1st meeting of this Committee, I reported to you about a major NIH policy initiative involving medical rehabilitation research. Then we were a few weeks away from convening a special task force on this topic.

The task force met at Hunt Valley,

Maryland on June 28th and 29th. It consisted of more than 125 individuals and was a remarkable assembly of scientific, clinical, and administrative expertise, broadly representative of the disability community. Critical resource support was provided by NIH staff and representatives of other federal agencies with programs related to rehabilitation.

The mandate for the task force was an ambitious one: to develop a comprehensive research plan for medical rehabilitation research that will enhance it and ensure its continued development.

You will recall that at an earlier discussion of this Committee, your principal recommendation was that NIH eschew for the moment any debate around organizational packaging and, instead, put the focus on the substance; that is, to develop a research agenda for this arena, out of which might come not only direction for the science, but more life as to what type of organizational arrangements within the NIH would be most appropriate.

As part of the background materials for today's meeting, you have received a prepublication

copy of the report of the task force. We are indebted to the 18 co-chairs and other members of the several panels, especially those who focused on selected scientific topics and the cross-cutting policy issues.

We owe a special note of appreciation to the two co-chairs of the overall effort: Dr. Theodore Cole, Chairman of the Department of Physical Medicine and Rehabilitation at the University of Michigan; and Dr. V. Reggie Edgerton, Professor, Department of Kinesiology at UCLA.

Dr. Moskowitz will begin this section of the meeting by providing an overview relative to the NIH initiatives on medical rehabilitation research.

OVERVIEW AND BACKGROUND

JAY MOSKOWITZ, PH.D.

ASSOCIATE DIRECTOR FOR SCIENCE POLICY AND LEGISLATION, NIH

DR. MOSKOWITZ: Good morning. You may recall that the genesis of the convening a task force on medical rehabilitation research stemmed both from the recommendations of an earlier NIH ad hoc advisory panel, which we call the panel on fiscal medicine and

rehabilitation research, which was chaired by Dr. Ed Brandt, a former Assistant Secretary of Health and now Executive Dean in University of Oklahoma Medical School.

That committee met on November 20th and 21st, 1989, and this Advisory Committee you met on January 26th to review the report of Dr. Brandt's panel.

The principal recommendation and guidance emerging from the deliberations of the two groups was that NIH assume, as Dr. Raub has just said, a leadership role in assisting the medical rehabilitation research community by developing a comprehensive research plan that would capitalize on the strengths of the NIH and its ongoing programs with the establishment of timely program recommendations.

As Dr. Raub has noted, the task force represented a remarkable combination of scientific expertise across a broad spectrum of scientific disciplines and a keen knowledge and awareness of the concerns and needs of the disabled community and, in several instances, a firsthand knowledge of the needs

of the disabled.

In addition to the June 28th and 29th meeting of the entire task force membership at Hunt Valley, there was a follow-up meeting of the 18 co-chairs and the 9 panels of the task force and Drs. Cole and Edgerton on August 10th at the NIH.

The report before you represents more than eight revisions and drafts and a large volume of correspondence since that August 10th meeting. But, despite these many revisions, there has been, I believe, to the credit of each involved, a continuing and unflagging enthusiasm for not only the process, but, particularly, for the product.

The report, as you see it in front of you, has been sent to 144 organizations that have interest in medical rehabilitation for their review. Their comments will be included in the final report as an appendix.

This activity and the report are precedent-setting. We believe it represents the most comprehensive perspective on the diverse field of rehabilitation medicine research that has to-date been

undertaken.

It addresses fundamental and applied sciences as well as outcomes research that will define the future course of medical rehabilitation research. In addition, it discusses the needs in research training and career development.

Moreover, it also establishes the potential for collaborative efforts across many disciplines and areas of science that haven't heretofore been pursued for medical rehabilitation research.

On November 16th, the President signed into law Public Law 101-613. A copy of that lies in front of you at your table. This law established the National Center for Medical Rehabilitation Research within the National Institute of Child Health and Human Development.

The report of the task force will serve as an important resource not only to the NIH as a whole, but also to the National Institute of Child Health and Human Development, in implementing this new legislation. You will hear more about this from Dr.

Alexander, the director of that institute, later this morning.

In addition to the task force, NIH policy initiatives in medical rehabilitation research are continuing at an accelerated rate.

The National Institute of Child Health and Human Development, along with the Office of Director, NIH, is developing an implementation plan for the National Center, to be presented to the NIH Director within 90 days of enactment of that legislation.

In addition and beginning this spring, NIH will be initiating what we call a "Frontiers in Rehabilitation Science" series to identify and stimulate scientific endeavors in medical rehabilitation research.

Since research progress often depends upon a variety of resources, including the size of the pool and the skills of highly specialized investigators, the task force itself has recommended that NIH convene a working group on medical rehabilitation research training for the purpose of identifying new research training programs and expanding existing ones to

increase the number of active researchers in medical rehabilitation research.

So serious is the shortage of investigators in this field that this initiative could not wait for the law to pass or an entity to be established and, consequently, we started planning for that initiative earlier this year.

The working group will meet on February 4th and 5th in 1991 and will be chaired by two individuals with extensive background and knowledge of medical rehabilitation research.

The co-chairs of the working group are: Dr. John Ditunno, Jr., Chairman, Department of Rehabilitation Medicine at the Jefferson College of Thomas Jefferson University; and Dr. Marcus Fuhrer, Professor, the Institute of Rehabilitation and Research at Baylor College of Medicine, and a past President of the American Congress of Rehabilitation Medicine.

I anticipate that the working group will provide further valuable guidance to the National Center of Medical Rehabilitation Research in

implementing Public Law 101-613.

Dr. Raub has already acknowledged the important role of the two task co-chairs, Drs. Cole and Edgerton. I would also like to recognize their outstanding leadership and commitment during this process and also that of two NIH staff members who dedicated many, many extra hours to this process: Dr. Lynn Gerber, who is the Chief of the Rehabilitation Medicine Department at the Clinical Center here at NIH; and Dr. Suzanne Medgyesi-Mitschang, who works in the Office of Director.

Task forces and reports such as this represent the dedication and hard work of many individuals. This report is very much the product of the experience, the expertise, the leadership of the two co-chairs and the commitment and dedication of both Lynn and Suzanne.

And one additional person we have, who really spent a lot of time on this is a very capable science writer/editor, Mr. Mark Bello. It was a pleasure to work with each of them in bringing this report to completion.

I would now like to introduce our two co-chairs: Dr. Theodore Cole and Dr. Reggie Edgerton.

Dr. Cole?

STATEMENTS BY THE CO-CHAIRS OF THE TASK FORCE ON MEDICAL REHABILITATION RESEARCH

THEODORE COLE, M.D.

CHAIRMAN, DEPARTMENT OF PHYSICAL MEDICINE AND REHABILITATION, UNIVERSITY OF MICHIGAN HOSPITAL

DR. COLE: Thank you, Dr. Moskowitz, and good morning, ladies and gentlemen, Committee members, Dr. Raub, and guests.

Indeed, that was a prestigious group of people who did work over the last several months in organizing a report, which you should have before you, on medical rehabilitation research.

When the Advisory Council to the Director of NIH last discussed rehabilitation research on January 26th of this year, several questions were raised. Does rehabilitation constitute a single scientific entity? What are the best mechanisms and organizations to foster rehabilitation research training? Is the focus for rehabilitation so diverse

as to be contradictory to the very notion of focus itself? Could research goals, once identified, be implemented? Might there be undue delays in implementing the next appropriate steps? Those are some of the questions.

However, there were three conclusions which seemed absolutely clear to me as I reviewed those minutes. Number one, the NIH should proceed promptly to delineate strategies for subsequent steps. Number two, a research agenda must be established. And, thirdly, other issues which now seem unclear, or then seemed unclear, would either be resolved or will be easier to see when the agenda is developed.

Now, that time has arrived. You have before you a document which sets forth the research challenges and opportunities for the future. Dr. Edgerton and I will discuss four important aspects of the report.

I will address the diversity of the field of medical rehabilitation and some proposed strategies to train the cadre of future scientists, who will take up these challenges. Dr. Edgerton will speak to peer

review issues and the dissemination of current scientific knowledge to the rehabilitation community. I have chosen selectively from the report and have augmented with my personal observations.

Let me first address the issue of the diversity of the field of medical rehabilitation. Its ultimate focus is on improving the quality of lives of people with impairments and disabilities. This makes the field necessarily large and broad.

The concept of quality of life is assuming an increasingly prominent role in all of health care, not just in rehabilitation medicine, where a reduction of handicap is virtually synonymous with an improvement in quality of life.

However, it is difficult to measure. Some feel that it cannot be done. It includes such ideas as social role, work productivity, and general well-being, all of which are largely experimental constructs and need further development.

Nonetheless, the concept of achieving a better quality of life transcends the broad range of potential rehabilitation interventions from those

aimed at reducing impairment to those that address the social determinants of handicap.

This Committee queried the nature of rehabilitation. Because it did, your task force thought it necessary to define rehabilitation research. Rehabilitation medicine research is, and I quote from the report, "the study of impairments, disabilities, and handicaps resulting from illness, injuries, and developmental processes that begin before birth and continue until the last stages of life.

"It focuses on health-related improvement in human functioning: physical; cognitive, behavioral, and social. Rehabilitation medicine research must include the application of new knowledge to the development of medical, behavioral, psychological, social, and technological interventions designed to optimize functioning after impairment, disability, or handicap.

"As defined here, the field encompasses research in a broad range of disciplines in the biological, social, behavioral, psychological, and

allied health sciences."

The bulk of biomedical research has already addressed the pathologies and impairments which may produce disability. However, little effort has been spent investigating the consequences of these pathologies as they affect human performance.

The successes of current-day biomedical research are attributed to the progressively clearer understanding of disease processes at the most basic level of biological functioning. Success has been found by reducing research problems into smaller units and ultimately into molecules and submolecular elements.

This successful process has generated an abundance of knowledge which has led to new pharmacological agents, surgical procedures, and other medical therapies which have prevented or reversed pathology.

However, and at the same time, there has been a lack of effective interfacing between this body of successful research and the functional consequences of many disability-causing impairments for which there

are not yet adequate treatments.

Medicine sees the disabilities produced not only by disease, but also by the very treatments themselves and, in so watching, has not adequately addressed the disabilities and handicaps which are the consequence of pathology, whether treated successfully or unsuccessfully.

What are the distinguishing features of rehabilitation research? Rehabilitation emphasizes an understanding of health-related changes in human functioning and performance and the mechanisms by which functions improve after the onset of disability.

The goals of rehabilitation are realized when maximum functional recovery has been achieved and disability and handicap have been minimized. The research of rehabilitation attempts to combine and synthesize basic concepts and integrate them at the level of complexity necessary to improve an individual's day-to-day functioning.

An understanding of rehabilitation requires the recognition that disability is distinct from disease. Clearly, similar disabilities can have

their roots in many different causes.

Moreover, limitations of function can result from the interaction between concurrent impairments which, by themselves, may have been relatively benign.

Because disability can arise from multiple causes, it is not a discretely defined topic of basic biological research, at least not within the current organization of the research efforts in North America.

The National Institutes of Health are generally organized according to disease entities. Partly as a result of this organization, the needs of rehabilitation research often seem to be discordant with the plans and missions of the major sponsors of biomedical research. However, I submit, these differences are not incompatible.

Now and into the future, the research interests of rehabilitation medicine must extend from the molecular level to human functioning. The task force concluded that three overriding needs are critically important to the progress of rehabilitation research: one, meaningful and feasible quantitative

measurements of impairments, disabilities, and handicaps and of the outcomes of interventions; two, there must be standards and guidelines for evaluation; three, current and existing rehabilitation treatments must be evaluated and their efficacy demonstrated or disproved.

Our review of rehabilitation research, as we have broadly defined it, leads us to two conclusions, First, we believe that there is underdevelopment of research in the area of functional limitations associated with impairments and disabilities.

And, secondly, there is a great need for the integration of disciplines so that basic advances within each discipline will be more quickly recognized and more efficiently utilized.

Your task force offered three general strategies for fostering and supporting the research efforts that will benefit medical rehabilitation. First, there must be a mechanism for cross-fertilization to allow the rehabilitation research community to participate in the basic

biomedical sciences. Without such input, many advances and opportunities from biomedical research will be overlooked.

Secondly, the field of rehabilitation must expand its clinical research base by encouraging investigators from within and outside of rehabilitation to study the functional outcomes of patients with diseases and medical impairments.

Thirdly, incentives must be created which will foster interdisciplinary clinical research which goes beyond discoveries about pathology and impairment and focuses directly upon disability and handicap.

What are the research training needs? On the one hand, we can be optimistic about the prospects for meeting the needs of the disabled population with biomedical advances which have great prospects if properly applied.

On the other hand, there is cause for great concern about whether rehabilitation medicine can capitalize on today's scientific advances. The shortage of qualified basic and clinical scientists and applied technological investigators is severe.

Indeed, the shortage of rehabilitation medicine scientists and the lack of support for research opportunities in the field are the primary obstacles to improving the effectiveness and efficiency of rehabilitation services in the United States.

However, America is blessed with bright minds. We are also fortunate in having the tools to train them. In addition, the American experience expects the marketplace of competition to allow the most able of these people to emerge and express their talents.

The biomedical sciences have a long and rich history of benefitting from our combined intellectual talents. However, experience has taught us that these talents require nourishing and encouragement. So, too, will the development of rehabilitation research.

The field has and will increasingly attract bright and capable people. However, we must act wisely to guide this resource into an area of national need.

We need to establish a system whereby

basic and clinical research training will cultivate these minds and allow them to have a salutary effect upon people whose impairments have led to disabilities and handicaps.

The current variety and level of research training support is too meager to accomplish the task. Although significant attempts have been made by federal and private agencies and organizations, a major and coordinated effort is now necessary to identify, attract, and train the rehabilitation scientists of tomorrow.

The effort must extend to include all of the rehabilitation-related specialties and subspecialties. These will include physiatry, neurophysiology, biochemistry, exercise science, psychology, epidemiology, bioengineering, nursing science, physical therapy, occupational therapy, speech pathology, and others, to name several.

Success will depend upon our ability to attract not only young and promising scientists into the field, but also to attract the attention of established and existing scientists in rehabilitation

and non-rehabilitation fields.

The task force finds it abundantly clear that many scientists working outside of rehabilitation are now producing information of great relevance to medical rehabilitation if only there could be a connection.

If existing medical research centers and institutions can identify accomplished investigators with rehabilitation research interests, they should be recruited to participate in a collaborative project.

Incentives should be developed which will assist the networking of established scientists who can contribute to rehabilitation research. Additional institutional support will be necessary to accomplish this, and outside support will also be necessary.

Collaboration within and between the basic and clinical sciences can be facilitated by interdepartmental appointments of faculty. All of these efforts will help to provide a nutrient base for the development of a cadre of rehabilitation scientists who will carry us into the Twenty-First

Century.

The task force strongly believes that mid-career rehabilitation research development awards should be established. They will encourage independent researchers in the basic, clinical, and applied sciences to enter the field of rehabilitation medical research. Investigators, who are both familiar and unfamiliar with rehabilitation, must be attracted into the field of rehabilitation.

A young academic investigator award should also be established in both the basic and applied sciences. These awards will attract junior faculty in the biological sciences, engineering, and related areas to the careers in rehabilitation medicine research.

Young investigator awards in clinical rehabilitation medicine research should be made to medical research centers, nursing schools, and other health professional schools.

Highly qualified young faculty should be trained not only in medicine, but in allied areas such, as occupational therapy, psychology, health

services research, and others.

Individual and institutional awards to support research training of students in graduate schools and medical schools should be established. Because the need for physician scientists in rehabilitation medicine is so acute, the award should also include summer research fellowships for students in medical schools and other incentives to attract young medical students to the field of rehabilitation and the research which must support it.

Similarly, individual and institutional awards should be developed to support research training of postdoctoral students. These should be in both basic sciences and clinical and applied research.

We believe the NIH should use its existing system of training and research awards to encourage and reward promising researchers. Those have been well-outlined in the report of June 1st of the Advisory Committee on reviewing the research training programs of the NIH.

Centers of excellence for rehabilitation

research and training should be established. They should be staffed by highly competent and equipped groups of researchers who have proven to be capable of effective research and training. They should especially be directed to interdisciplinary areas of study.

This mechanism will also help to help to meet the need for a critical mass of basic and clinical scientists who are needed to provide leadership, stability, and high quality environments in the field.

It is, indeed, fortunate that we are considering these issues today. Now there is the recognition that disabled and handicapped people can and want to contribute to our society. They can hold jobs, travel through their communities, and engage in activities that much of the public takes for granted.

This philosophy stands behind the Americans with Disabilities Act signed into law by President Bush just last month. This civil rights law will help to reduce the social and economic barriers confronting people with physical and mental

limitations. It also provides us with a springboard to strengthen the role of rehabilitation in helping people with disabilities become more active members of our society.

I thank you for your attention. And I would like now to ask Dr. Reggie Edgerton to come to the podium and complete this presentation.

V. REGGIE EDGERTON, PH.D.

PROFESSOR OF KINESIOLOGY,

UNIVERSITY OF CALIFORNIA, LOS ANGELES

DR. EDGERTON: Dr. Raub, Advisory Council, and guests, even eight months ago, I would have considered remote the possibility of addressing you today on the topic of medical rehabilitation research.

I presume that my work was not generally recognized in rehabilitation circles, although I have always thought it was very relevant. And, indeed, I have had only tangential contact with the professional aspects of medical rehabilitation.

However, someone at NIH has been paying attention, and I am truly grateful and encouraged that I was asked to serve as co-chair with the

distinguished Dr. Cole on the Task Force on Medical Rehabilitation Research.

Based on my review of your previous discussions on today's issues, it is clear that you fully recognize that our nation is not adequately addressing one of the most costly medical problems, with costs being assessed in human and economic terms.

I would like to focus on the two key points which I feel we must and can address effectively. And, in fact, these major points have already been raised and discussed by previous panels and your Advisory Council. However, I can develop conceptual strategies to deal with specific problems that can facilitate rapid solutions and at modest costs.

The first problem is that medical rehabilitation research is not reaching medical rehabilitation. All too often, there is an incredible gap between the basic information available, which should be incorporated into the intervention strategies in medical rehabilitation and that which is actually being practiced.

The upside of this is that major improvements can be realized in medical rehabilitation if we can: one, develop a mechanism for assimilating the appropriate information; and, two, incorporate this information into the medical curricula and clinical practice.

The presence and magnitude of this gap between basic science and clinical practice has been astonishing as well as discouraging. Why does this gap exist? We know that our medical system can respond rapidly to technical advances and, in some cases, it appears to be too rapid.

Clinicians are waiting at the laboratory door for the next gene replacement breakthrough, for the next drug, or for the newest techniques in organ and tissue transplants.

But in rehabilitation science, there are too few scientists creating new information, and there are too few clinicians prepared to interpret and utilize the new data.

In spite of these limitations, we can be optimistic regarding the remarkable progress being

made in what should be viewed collectively as rehabilitative science.

Unfortunately, under the present conditions, there is a significant amount of useful information lying dormant. It is as if we have raced the first 90 meters, but can't manage to finish the last 10.

What do we have to do to finish the last 10 meters? First, identify why we stop at 90. It seems quite apparent that our present organization mechanisms, which affect priorities and choices related to health care, have not served us well.

We know that the medical establishment can incorporate cutting-edge science. We know that every government agency and many private agencies want to accomplish the goals that have been outlined in medical rehabilitation.

We know there are outstanding and caring people in medical rehabilitation and that the scientists who contribute to the rehabilitation sciences are as good as in the other branches of science.

What can we do to correct organizational inadequacies? As Dr. Cole has just outlined, the most crucial and solvable problem is training. We must enhance and solidify the concept of rehabilitation science. The basic sciences can flourish under the framework of rehabilitation science, which can, in turn, contribute to medical rehabilitation.

We must establish a strong research base within the clinical environment which will assure that the cutting edges of science are incorporated into the medical curriculum.

And we must establish a pipeline that is as facilitating as possible to interconnect the scientists contributing to rehabilitation science and the clinicians in medical rehabilitation.

We have an excellent model to follow in the Society of Neuroscience. I attended its first annual meeting here in Washington in 1971, when 269 abstracts were presented.

This multidisciplinary organization just had its 1990 annual meeting, in which there were almost 8,000 abstracts presented and more than 12,000

participants.

Given the meager start and the current status of the Society of Neuroscience, the multidisciplinary nature of medical rehabilitation should not be viewed as a great obstacle in this particular case. In previous discussions, it was obvious that this was considered a major obstacle.

The NIH has not been considered by some to be a strong facilitator in medical rehabilitation research. And I'm aware of the levels of support that various institutes list as related to medical rehabilitation and the contrasting views that some of these levels of support are overestimates and the belief of some that it is actually far greater. But let's not deal with perceptions of the past or even the present. Let's address the future. This leads to my second point.

In spite of the large sums of money that NIH contributes to medical rehabilitation, the peer review system at NIH is perceived by those in medical rehabilitation to be biased against research in their specialty.

The opposing view is that the rant proposals that address medical rehabilitation generally are of low quality. If both of these perceptions are not addressed by NIH, all our efforts will be in vain.

I have been fortunate to have been a continuous recipient of and contributor to the NIH peer review system for more than 20 years and feel that I can address this issue in a balanced manner. As a basic scientist, I have sensed bias of reviewers and even my own colleagues.

There has seemed to be a threshold beyond which it is undesirable to cross for fear of being perceived as being too "applied." Further, there is a common perception that if one's work is applied, then the science is of lesser importance.

When every NIH grant is requested to state its potential meaning to medical research, many investigators view this frivolously or even contemptuously. Certainly in most major universities, there are few signs that the academic excellence of a life scientist is enhanced by addressing practical

health-related problems.

Of course, these views are not held by all, but they do exist and they do have an impact on decisions at many levels, which inevitably impact medical rehabilitation.

So what can be done about the peer review systems that will promote accelerated progress in rehabilitation science? An excellent start in correcting a perception that NIH does not adequately support medical rehabilitation research is to actively advocate it.

If NIH takes the position that this area is a high priority, scientists and universities will take that lead. Rehabilitation science will be viewed as a desirable direction in which basic scientists can steer their efforts.

Medical students will view this branch of medicine with the status and esteem that other specialties seem to experience. Medical schools will be motivated to incorporate rehabilitation science into their curriculum.

Such a proclamation of support for medical

rehabilitation research by NIH need not compromise the standards by which it is known to function.

I offer two tangible goals to which NIH and other government and private agencies must commit: one, a commitment to provide the leadership and the financial support required to generate the enthusiasm and optimism needed among scientists, physicians, engineers, educators, and technicians; and, two, a commitment to invigorate research and medical training so that the medical rehabilitation can function at its full potential. The payback in human resources, quality of life, and our national health costs could be astonishing.

An immediate start toward these two commitments must assume equitable representation of medical rehabilitation research on study sections and perhaps a separate study section under some circumstances.

There must be a concerted effort to expand the pool of scientists and clinicians from which excellent proposals can be expected. Longer range goals must include the development of mechanisms to

optimize the potential contributions from the many government and private agencies that contribute to the quality of medical rehabilitation.

It is my strong belief that NIH must take the leadership in these difficult, but essential, tasks that this and previous panels have been discussing.

We have a clear mandate by our country and recent legislation reflects the interest and resolve to improve medical rehabilitation. The enthusiasm of our task force has been a clear demonstration of the professional commitment needed. We must seize the opportunities that lie before us.

Thank you.

COMMENTS BY THE DIRECTOR OF THE NATIONAL INSTITUTE OF CHILD HEALTH AND HUMAN DEVELOPMENT

DUANE F. ALEXANDER, M.D.

DIRECTOR, NATIONAL INSTITUTE OF CHILD HEALTH AND HUMAN DEVELOPMENT, NIH

DR. ALEXANDER: As Dr. Moskowitz indicated, President Bush signed the bill on November 16th. It became Public Law 101-613 and established

the National Center for Medical Rehabilitation Research within the National Institute of Child Health and Human Development.

In governmentese, that starts the clock ticking for a number of deadlines that need to be met. We in the NICHHD have been at work since that time to begin implementation of that law.

The NIH has a strong tradition of doing an outstanding and even enthusiastic job of implementing legislative directives establishing new organizational entities, the latest examples being the National Center for Nursing Research and the National Institute on Deafness and other Communication Disorders. We at the NICHHD intend to continue that tradition.

Establishing this center, in doing that, it will be our plan not to take over, move, or incorporate research in other NIH institutes or other government organizations where existing research generally is most appropriately conducted in a programmatic context where it exists.

Rather than a change of location, it will

be our intent, given the resources to do so, to provide new research training programs that will meet the most pressing needs and fill the gaps identified in this report, as well as provide coordination and facilitation and encouragement of existing medical rehabilitation research.

The new legislation directs us to do several things. First is to actually establish the center within the NICHHD. The paperwork that makes this administrative change is in process.

And within three months the National Center for Medical Rehabilitation Research will join NICHHD's existing centers, our Center for Research for Mothers and Children and the Center for Population Research, in the institute.

Like those centers, it will be headed by a director reporting to the institute director. We are preparing the recruitment for this center director. I will enlist the aid of the scientific and advocacy communities in finding the best person for this position.

The second charge is to set up within 90

days an advisory board to review and assess priorities and provide policy advice to the center director and the institute.

He will have 18 members, 12 of them professional and 6 lay, plus 11 ex officio members. Again, we will seek the advice of the research and advocacy communities to guide the NIH Director in making these appointments.

Our third charge is to set up a medical rehabilitation coordinating committee, also appointed by the Director of the NIH, to make recommendations of research and activities in medical rehabilitation research. It will include representation from the NIA, NIAMS, NHLBI, NINDS, and other NIH institutes, as well as other government agencies.

Fourth, and most relevant to this agenda topic, our charge is to develop a comprehensive plan for the conduct and support of medical rehabilitation research.

This plan is to identify current medical rehabilitation research conducted or supported by the federal government, to identify opportunities and

needs for additional research, to propose priorities for such research, and to make recommendations for coordination of such research within the NIH and with other government agencies.

The deadline for completion of this plan is 18 months, at which time the NIH Director is to submit the plan to the President and to the Congress. It is, thus, doubly important that the research plan you are now reviewing has been done and has involved the research community so extensively.

With this plan and the comments on it provided by the 144 organizations to which it was sent and by the Director's Advisory Committee, we are not only off to a running start. We are nearly home as far as content is concerned.

We will certainly seek additional advice from the advisory board and the coordinating committee on content, but the excellent work done so far will allow them to focus largely on priorities, coordination, and implementation and should allow us to finish the task in less than 18 months.

We at the NICHHD look forward to the

comments from the DAC today and to moving ahead with what Dr. Cole, Dr. Edgerton, and their colleagues have thus far so notably advanced.

DR. RAUB: Thank you very much, Dr. Alexander.

DISCUSSION AND RECOMMENDATIONS OF THE ADVISORY COMMITTEE TO THE DIRECTOR, NIH MEMBERS, ACD AND ICD COUNCIL REPRESENTATIVES

DR. RAUB: The floor now is open for comments, for questions for any of our three speakers from the members of the Advisory Committee or the representatives of the councils and boards. Dr. Korn?

DR. KORN: From my understanding of the content of these documents and the comments of the two speakers, what kinds of physical structures are you thinking of as a good way of implementing the programs that you persuasively argue need to be established?

In other words, you're talking about gaps in knowledge base or lack of channels or conduits or whatever and the dearth of certain kinds of strengths within the community.

How do you intend to pull them together

and bring them in? Do you see this as largely an initiative that's highly multidisciplinary from the outset?

Are there existing centers within the discipline that already have that critical mass of capacity or what?

DR. COLE: There are some centers now which exist that have that capacity. Unfortunately, there are not very many of them. There needs to be a mechanism so that these groups of people, I think, can join their strength and talents towards a training objective. But there is a huge need for more. So the structures need to be created.

DR. RAUB: Would you perhaps elaborate on the kinds of structures?

DR. COLE: Well, I can offer my own personal views. One of the strategies that I would personally think might be productive would be for some of the existing centers of excellence to come together and form a consortium for training so that some of the best people, who might be attracted into the field as newcomers or who might come out of training and want

to get into the field, would have an opportunity to receive the very best of training by capitalizing upon the strengths in the several centers of excellence.

I think a training mechanism like that, given several years, would begin to push out into the academic world and the private sector, those people who are going to lead us into the sciences of rehabilitation.

DR. RAUB: Is it fair to say that there's not a single center with comprehensive coverage right now?

DR. COLE: As I would define "comprehensive," I agree with that, yes, because I'm defining "comprehensive" as a thorough integration of the basic and fundamental sciences with the applied and clinical sciences.

DR. RAUB: Dr. Williams?

DR. WILLIAMS: If I could just speak for a moment to try to address this question from the point of view of aging and geriatrics? The current Appropriations Act, for one thing, addressed our institute to develop Pepper Centers of Excellence in

independence for older Americans, and the clear theme of their intent, as well as our plan, is to emphasize intervention studies to improve the functioning and independence of older people. That will be a focal point. Now, these are research and training centers with an emphasis on the career training as well as the research side.

Now, it still remains to be seen exactly how far these go. It will depend on the applications we get eventually in terms of the interdigitation of basic and applied work, but they are clearly conceptually aimed at including these.

I might just mention a couple of other things that I think relate. We have issued one, and are about to issue another, request for applications.

Our program director in this area, Evan Hadley, is good at acronyms. And the one that has been issued and responded to is called FIXIT, in which we have funded, along with the National Center for Nursing Research, eight program grants to undertake improved independence in frail older people with disabilities of problems of falls, osteoporosis,

osteoarthritis, other disabling conditions.

The second one that will be entered shortly is called STOPIT. It is being developed in coordination with the National Institute in Arthritis and Musculoskeletal Diseases, Skin Diseases. And that will focus on osteoporosis in people over the age of 65 as being a partly neglected population of both women and men, placing the serious problems of osteoporosis.

The final thing I would say is that the National Institute on Disability and Developmental Research of the Department of Education has supported some centers on rehabilitation research.

Two of those have been focused in aging, one at Ranchos Los Amigos at UCLA and USC in Los Angeles and another in Pennsylvania, a consolidation of three of the medical schools there, where they have conducted both basic and applied research on aging-related rehabilitation.

I think there are some examples. There is plenty of more development to be done, but the concept is clear, and we have an appropriations

directive to proceed.

DR. RAUB: Also an excellent illustration of the tethering argument that Dr. Alexander was raising, that many activities are connected, and appropriately so, within the context of various institutes. Our issue, therefore, is the breadth and the coordination of those, as well as exploding the new opportunities.

DR. EDGERTON: Could I make a few comments about this? I do not have a clear idea myself of the best mechanism to accomplish what we have been talking about, but let's look at the core problem the way I see it.

I cannot look one of my students in the face, for example, and recommend that they go into a science that would be considered rehabilitation science, and I can't do that because there's not a place for them to go. There's not clear evidence that there's a future that they could progress in their career in rehabilitation science.

So what's the problem? The problem is within the universities, within the medical

curriculum, as well as NIH. This is why I suggest that somehow NIH and other government agencies have to play an important leadership role. They have to assure the scientists that there is a future here.

Right now there is just not the mechanism. And I don't know enough about coordination of government agencies to think that I could make the best suggestion here, but I have a clear mind of what the problem is. I think NIH can solve it.

Neuroscience developed not because of high level government agencies coordinating the development of neuroscience. It developed because there was a need from the intrinsic interest among the scientists. It was clear that there needed to be a lot of coordination among the scientists.

Somehow there must have been a mechanism for people to look in the future and say "This is the way to go." And somehow we have to say to our new scientists that this is a way to go.

DR. RAUB: I think you hit one of Dr. King's favorite buttons.

DR. KING: Like Dr. Edgerton, I was a

charter member and played a role in the establishment of the Society for Neuroscience in 1970 and '71. What had happened then -- and I think it is relevant and important to today's conversation. What had happened is that the time simply had come in terms of information becoming available from a whole host and variety of fields and developed to the point that there was a feeling of urgency on the part of scientists to put those different kinds of information together.

There was a variety of neuro and behavioral discoveries. There was a variety of scientists themselves needed and available to carry out the work. And there was a real sense of frustration of those who were in fields, the more traditional fields of physiology, anatomy, psychology, pharmacology, and endocrinology, and so on, to get together and to become part of each other's discipline.

A year later we established at the university at which I was then the second department of neuroscience in the country. Now, the executive

committee of the medical school was deeply opposed to it because it meant cutting one more slice of the pie, but they were also opposed, and so were many scientists in traditional disciplines, opposed to the concept of training people in a discipline that nobody had heard of or almost had not heard of.

They said, "You won't be able to place your graduate students. You won't be able to attract graduate students. You won't be able to bring faculty into a department with a funny name like this if we don't know what it represents."

What happened was we had absolutely no difficulty in recruiting first class faculty members. Our graduate students went out without exception to good postdoctoral programs or good faculty positions in a whole variety of traditional and nontraditional departments, ranging from psychology and psychiatry, at the one hand, to molecular biological-type departments and system studies, physiology, at the other end.

I get the feeling that what has come about here now and the reason that we're here discussing

this today and that it's been such an issue for a considerable period of time is that rehabilitation medicine finds itself in the same situation. The forces have been developed in terms of information, in terms of available scientists, and what is needed now is the mechanism for executing it.

In the case of neuroscience, there was no, as you pointed out, NIH plan to "Let's set up a special training program. Let's do this. Let's find a place for them to go," and so on.

But I have perhaps intuitive and perhaps unwarranted, but, nonetheless, confidence that this will occur by a natural process of the forces of doing the things that we have talked about here and that Drs. Cole and Edgerton have outlined.

DR. RAUB: Okay. Other comments, questions? Dr. Korn?

DR. KORN: There is a model that I have some familiarity with that might or might not be a useful thing to look at, and that is that the Veterans Administration has established some number of centers for rehabilitation engineering research and

development or rehabilitation science research and development in a number of dean's committee hospitals around the country.

We have one in Palo Alto which is a conjoint venture between the School of Medicine and our School of Engineering that I think has been extremely effective in bringing at least those two kinds of disciplines together on problems quite highly focused on restoration of function, if you will, or something of that sort.

I know that the DVA has been reasonably content with the progress they have gotten out of that investment. I have no idea how extensive it is. I don't know how many of those centers there are, but there is that model, for whatever it's worth, of trying to recruit people into rehabilitation medicine research and development.

DR. RAUB: Comments on Dr. Korn's comments?

DR. COLE: Yes. I think that is a model, and there are other examples of that. That particular program has moved towards development along

rehabilitation engineering goals.

The hope I have is that the broader field of rehabilitation, which we have sketched out and which, I think, is laid out in your report, will be addressed and that we will be able to create the leaders who will be able to move about in this broad field.

There is not, in my view, today -- in even my own department, which I consider to be rather good, still you don't have the basic sciences in enough abundance and integrated closely enough with the clinical sciences.

And so I have a difficulty looking at young people and saying "There is an exciting future for you in rehabilitation in the academic community" because half of the medical schools in the United States today do not even have departments or divisions of rehabilitation medicine.

DR. EDGERTON: I would like to make it clear. There is another point that I feel strongly about, that it is essential that the basic sciences in the various institutes remain within those

institutes.

I think we would be making a major mistake if we expect a center for rehabilitation to be responsible for supporting the basic research. One of the things I was greatly impressed with during these panel discussions was the obvious interconnections from one institute to another institute, the interconnections that should be there, the problems that the Cancer Institute sees, the musculoskeletal and so forth. The need for the interconnections is just striking.

And we have to take advantage of the basic science within each of those institutes. I'm confident that that has operated pretty well, but we're not getting that information out of the institutes and into medical rehabilitation.

DR. RAUB: Ron?

DR. LAMONT-HAVERS: For obvious reasons, the center could not be included in the Fiscal Year '91 appropriation. I wondered if Dr. Alexander could address the problem of the budget for this year as well as positions and what he's planning to do Fiscal

Year '92.

DR. ALEXANDER: For the current fiscal year, our expenses will be minimal. We do have the expenses of recruitment for a director for the center, for hiring some staff that will probably be brought on toward the end of the fiscal year, for holding meetings of the advisory board, setting that up and so forth. These will not be large expenses.

We have put in a request to the NIH Director for some funds to meet these costs from the Director's reserve that has been provided for this year. We would hope that we will receive some funds to carry out those responsibilities this year.

We have put together a request to be added to the '92 budget. Because this came so late in the process in terms of its actual signing of the legislation by the President, it's not yet clear just at what stage in the process we will be able to fit the actual request in.

We may have to depend on activities from the Congress during the appropriations hearings to provide funds for Fiscal '92, but that's not entirely

clear yet.

DR. RAUB: For the moment we're taking the view that we'll be hard-pressed to explain why the '92 request would be silent on this topic, given the extensive discussion over several years, the activities of this group, and the legislation, in particular.

As Duane, indicates, the bus is well down the road in that budget development process. And if we can catch up with it in some way, then we'll attempt to have a reasonable proposal in '92 and some anticipatory aspects of that in '91.

DR. LAMONT-HAVERS: So, as far as programmatic activity, then, that would be relatively minimal in '92, but begin to pick up in '93, '94?

DR. RAUB: I won't prejudge the '92 other than we will attempt to have a foot placed firmly on the path along the lines of the recommendations here, but it's, by definition, too early to tell.

Dr. Shulman?

DR. SHULMAN: This has been a very interesting morning and, actually, I personally,

sitting on the sidelines, to some degree, with participating in all of the activities, want to commend both Dr. Cole and Dr. Edgerton for, I think, what is actually a fantastic job in a very, very difficult area. I thought the conference itself was really quite remarkable.

I do have a question, and that is to ask Dr. Cole and Dr. Edgerton to elaborate, to some degree, on what they view as an optimal research training operation.

Dr. Edgerton, you mentioned the importance of incorporating basic sciences in various and several disciplines into that effort, obviously, rehabilitation research, more focused research training in terms of functionality and outcomes, et cetera. How do you view the optimal situation?

DR. EDGERTON: Well, I think my recommendation would be that we provide the opportunity and the encouragement for selected universities or universities to propose to NIH programs that would have some of these objectives that we're talking about.

I think we need an environment that will include M.D.'s and Ph.D.'s. And I think we can progress more rapidly if we focus these efforts in specific universities, as opposed to having individuals who are very well-qualified going into programs, many of the programs that exist today, but are getting swallowed up in the system because their colleagues are not on the same level that they are or do not have the same interests.

So we need a few centers from which we can expect our leaders in the future to come from in the next few years. And so my recommendation would be to focus our efforts to try to find some universities that would be interested in accepting these challenges and expect our leaders to come from those centers in the next few years. And then that's where our major students will be coming from.

One more brief comment, I think it is as important to have the focus on the basic sciences with the connection in the clinical world as it is the opposite; that is, with the programs focused only in the medical school. And the reason I feel that way

is because, as I have said before, there are a lot of basic sciences that could be incorporated into the medical curriculum.

DR. COLE: I would like to add only a thought to that. The optimal environment is the antithesis of what is now so often the case, which is isolation. An individual who is inclined towards rehabilitation research often finds him or herself in relative isolation and, if he or she wishes to seek collaboration, often has to go outside his or her own department to other places.

If such an opportunity were to become available, what I would do, as the appointed person within my own school to foster the development of rehabilitation research, I would go out into my own institution. I would sit down with Dr. Yamada. I would sit down with the Chief of Neurology, Dr. Gilman. I would sit down with the Chief of Physiology. I would go around the institution like that and discuss ongoing research which relates to rehabilitation. And we'd discuss future possibilities that could be created by joining together.

I think in that way I certainly would be able to access the power and resources which would allow my own institution to make a much wider impact than it has now. So it's that kind of collaborative effort, bootstrapping in many respects and with all of the characteristics of bootstrapping.

DR. RAUB: Rodney had his hand up before. Did you want to say something?

MR. NICHOLS: Thanks, Bill. I wonder if our presenters in their impressive case could elaborate a bit on this parallel of the formation of the neuroscience society 20 years ago.

My impression is at that era there were many young, mid-career, and senior what's called biomedical scientists from many fields moving into what became known as the neuroscience.

So to what extent is that true today in rehabilitation research fields? To what extent are the top people in medical schools and molecular biologists seeing the purpose and the health potential in rehabilitation?

My second question is very much more

prosaic, and it may be premature. In thinking about this plan, I gather it will come up in 18 months. What would be the number of trainees per year that this new rehabilitation center would support?

DR. COLE: Let me try the first. I feel less able to respond to the second. There are now some people who are bright people and trained scientists who are in the field of rehabilitation who are isolated, relatively isolated, who can come together and have a much greater impact by coming together.

The clinical field of rehabilitation is one of, if not the most, rapidly advancing field in medical specialties today. That is, there are more candidates applying for training in clinical rehabilitation, as compared to the available slots. And that ratio is most competitive in the field of rehabilitation. Perhaps there is only one other field that is more competitive now.

So now is an ideal time to make available a training opportunity because of people waiting outside the gate to come in if they can see an

opportunity.

How many trainees, I can't begin to tell you. I really don't know. I think that would take the wisdom of more than is in my head. But in the report, you will find reference to how many trainees in rehabilitation engineering are needed, and the approach that they took in the report might be used to describe how many others from other specialties.

MR. NICHOLS: If I could just follow it for a minute, my point was not so much whether physicians see that there are patients who need to be cared for, which I think is the answer you give, but whether there's an intellectual power that's drawing the best young investigators, whatever their professional background, and particularly the sort of mid-career and senior people. It's indicative at all levels in the age group, where the brightest people are seeing opportunities.

I don't think you've touched that in what you've just said. Excuse me if I missed it.

DR. COLE: No. I think I was not clear. I'm talking about the scientists who can contribute

to rehabilitation. There is a lining up of people. And in that crowd, I think, are a number of people who can do that.

MR. NICHOLS: All right. Okay.

DR. COLE: The companion question, mid-career, are there people who are knocking on the door now? The answer is emphatically no, and there need to be.

According to the panelists, who met several times, many of them coming from outside of the traditional fields of rehabilitation, they said there are many people who are doing research right now that is related to rehabilitation; they just don't know it. And there needs to be a mechanism so that they can know it.

DR. EDGERTON: Let me address the neuroscience issue. There is an important difference between the development of what I think rehabilitation science could be versus neuroscience.

Neuroscience developed, I think, because of the apparent need of investigators in different areas feeling that they could learn more by

collaborating out of those specific areas. So that did not develop because there was a medical need, I don't think.

In this particular case, we're starting with the premise that there is a medical need. And I think that has clearly been established. So there are different forces.

But the reason I brought up the neuroscience is because it shows that there can be very effective interdisciplinary science, and I think that's the take-home message here. The motivation, or the driving force, will not be the same here.

DR. ALEXANDER: If I could just comment, one of the agenda items planned for the February 4th meeting on medical rehabilitation research training will address trying to get some dimension on scope and size and numbers and disciplines and levels of where we might direct resources for our training program.

MR. NICHOLS: One of the reasons I asked that question, as Bill will remember, in talking about training in general across the NIH, we recognized the very difficult conceptual and quantitative problems

in deciding what priorities to give to what fields and a lot of different ways of looking at priorities.

You all have to map whatever you do onto what is already a tough problem.

DR. RAUB: Go ahead.

DR. von HIPPEL: Well, I just wanted to add to this the question, specifically, when you think about the basic science that will go on here, -- and I'm talking, of course, about the levels of neuroscience and biochemistry and molecular biology and so on -- it seems to me what you need is much more of an integrative role than you do the business of actually getting more people to do the kind of work that's already going on under this new heading. That might be more discursive than helpful.

I mean, do you view that the kinds of basic scientists you need to train in this area are people who can pull together the existing body of knowledge and direct it and integrate it in some way, but not necessarily pull people out of established disciplines who are already focused on basic problems of other kinds, but which have applications?

DR. EDGERTON: I think there is a natural, and has always been, great excitement for scientists to go deeper and look in more detail at more fundamental mechanisms, and that is extremely important. But I think what has been left behind is the more integrative type of sciences. It is just being left behind.

And when you think about the gap between the very basic science that's being done and what has been referred to repeatedly as outcome measures, one of the other things as a basic scientist I was impressed with after having participated in this panel is that there is a great need to understand how these interventions impact the quality of life of an individual. And, as we break things down, we get further away from that.

So we have to have some method to let scientists know that there are things and very important problems that are being left behind, and this is one of them.

DR. von HIPPEL: But it would mean integration, essentially, in terms of the kinds of

people that you would recruit as trainees and so forth, people, residents starting, say, a biochemistry component of a rehabilitation science department, or something like that. Is that correct?

DR. COLE: Yes, that is correct. There would be a great effort at integration. A special example is that every summer I send two of my faculty to Wood's Hole Marine Biological Laboratory. We aren't doing marine biology in our medical school, at least not in my department, but I find that integration is very stimulating to the research environment in my own department.

DR. GLITTENBERG: It feels to me as if we're going to go the next 10 meters that there needs to be a restatement of the values of basic science. And, as I hear you discover what's going on in the integration and the mechanisms needed for it, I wonder if you would speak a bit more about where you see the dichotomy between basic and applied because it feels to me if that is really to be a natural process, as Dr. King has brought out, that the last 10 meters have to be a synthesis of science, rather than the

dichotomy.

And, as many of us sit here representing councils, the only place I really have access to the synthesis is in the study sections. And when I think in terms of what you said of the antagonism between what might be seen as the basic scientists and the applied, I think that's a false dichotomy and where we have come now to a point where we need to restate the value of the science.

Could you speak a bit more on this and clarify what I heard you saying in the last few minutes?

DR. EDGERTON: Well, I think that when technology develops, technology is a major driving force for biological sciences and medical sciences. I think we all recognize that. And there's a tendency for all of us to emphasize the new, the most technological developments. You use the electromicroscope or the stygian microscopy.

That doesn't mean that the problems that you were investigating before you had that instrument have been solved. It just means that you can go a little deeper into a problem. And what we have done

is as we have progressed, we have kind of left the whole human behind.

I don't want my comments to be read as the basic science being unimportant, but it's just what we're leaving out. And I think we must concentrate more on integrating the basic information that we're learning.

It's not just a matter of information resources and gathering information and someone saying "Okay. I've put everything together." There is a lot of science that needs to be done that involves more integrative science, physiology.

And there is a perception, I would say, among scientists that it's better to try to delve into the more detailed, and it's not as vogue or it's not considered as important to back off and to try to integrate information. Somehow we have to figure out a way to encourage scientists to do that.

DR. RAUB: Dr. King?

DR. KING: I hate to harp on the department I started, but two of the things that we did that we felt were critical and important to what

we wanted to achieve -- and that achievement was not merely the training of applied and basic scientists, but a coordination and collaboration of clinical and basic sciences.

So we had two stipulations in the department almost from the day it began in 1970. One was that our department would be open to and responsive to adjunct appointments and collaborations from clinicians in departments relevant to neuroscience: neurosurgery, neurology, ophthalmology, and so on.

I had the good fortune to spend 10 years in that university before the Neuroscience Department in the Division of Neurosurgery and I knew what neurosurgeons were like and what neurological clinicians, in general, were like, regardless of their specific specialty.

And I knew that there were people there -- we were fortunate in this -- who wanted to be more involved in basic science, but, because of the commitments at their departments and their clinical commitment and sometimes the leadership of that

department, didn't have the opportunity to.

But with the opening of the Neuroscience Department, that became available to them. And, at first, it was scoffed at and people said "Nobody will come down to see you, and it's not going to happen." It did happen.

The second point was that -- and I think this was a rather bold step that was not appreciated by all of the faculty in the Department of Neuroscience, especially basic scientists, nor appreciated entirely by some of the students until it got underway and started to work; and that is, we set out a requirement that our basic science students, graduate students, and faculty would attend the clinical conferences and grand rounds and participate in rotations on clinical areas, where it was appropriate. And it worked. It broadened them.

And if we now look today, 20 years after that department was established, and see where these people are and some of the ideas they have generated, the kinds of collaboration they have done, I think it worked at least a little bit. And remember we're

talking about not a national program here, but just one department that was trying to do something unique and unusual.

We did have resistance. We did have resistance. And I would agree with your comments. And this is one of the reasons I would say that we need to focus our resources in a few universities.

So we would have to have the total environment. We can't just have one or two people, good people, in a department. We have to have a total program. And I think that that's an excellent way to proceed.

And I wanted to just add the one most critical factor was to select the presence -- we were fortunate in that -- and the selection of the leadership and then the faculty, the younger faculty that came in, and the selection of graduate students who were directed toward these goals. That was absolutely critical. Without that, it wouldn't have worked.

DR. COLE: Dr. King, I subscribe to your observation entirely, in part by your report of

experience and clear success because I believe that can happen in this other model.

So I hope we can get on with it and perhaps follow some of the advice that we're hearing here this morning.

DR. RAUB: I thought I saw another hand over here. Any other questions? Yes?

DR. RUBEN: I want to ask Dr. Alexander, as a representative of one of the institutes, I was wondering how you would be going about assessing the role that other disciplines play.

As I read through the workshop at Hunt Valley, I was interested, but also found a lacunae in the whole domain of sensory habilitation, especially, my own area, in communication disorders, which, at least from the experience of my institution for two decades, fills a lot of rehab medicine.

Also, unfortunately, people usually have multi-system defects. They have deacon's onychoschizia and communication, whether they're broken hips or this, that, and the other, always comes into play.

So I was wondering how you were going to assess the strengths and abilities of other institutes and to begin to integrate this into the program.

DR. ALEXANDER: Well, obviously, in multiple ways, one of the things that we'll be addressing will be the need in the training area, for example, the importance and need for at least some individuals for interdisciplinary training and medical rehabilitation research.

One of the other charges in the legislation to us is to develop within the course of the year working relationships and boundaries, if you will, as well as interactions with all of the other institutes and all of the other agencies that are involved with this area of research.

Now, we intend to do this more as a way of determining where the opportunities for interaction lie, rather than drawing fences. So I hope that we will go about this in a way that will facilitate the kind of interaction and interdisciplinary work that you and many others in the community espouse, rather than finding ways to draw boundaries and in the way

of erecting fences.

DR. RAUB: Comments, questions? Frank?

DR. WILLIAMS: If I can just make one other comment or raise a question? I certainly am impressed with what Dr. King has to say about the evolution, or almost revolution, rapid evolution, of the neurosciences. And, certainly, the sciences were ready for these steps.

But, in addition, there has been an infusion of funds that help make all of this possible. I would just say that I myself hope that this Advisory Committee will support the goal of the infusion of funds into the area of rehabilitation research.

DR. RAUB: I have a question, and then I will address principally Drs. Cole and Edgerton, but others are free to go at it as well. This is under the heading of the first axiom of the bureaucracy: Never ask for advice unless you're prepared to act on it. And also I risk precipitating the discussion that will come later.

But the report makes very clear that in order to jump start the types of things we would all

hope to see in this area. There needs to be more fostering of basic science. That usually means research project grants around here. There need to be centers in terms of the multidisciplinary and concentration in momentum. There obviously needs to be research training.

I know the answer is all of the above, and I know balance is the key word, but if we had to choose one of those, where do we start?

DR. EDGERTON: One of my comments was that we can approach, I think, the most urgent problem with modest costs. And what I meant by that was that we've paid a lot for the basic research that, frankly, is volume-dormant.

And we have to get the human resources that can take that information and get it into the medical rehabilitation. So I would put that as first priority. We have to get qualified people.

The basic research, I think, is going to be progressing, not all of it, of course. And that's going to need a clear infusion. But we can make the most rapid progress immediately by training people.

DR. RAUB: Dr. Cole?

DR. COLE: I agree. There is a crop out there to be brought in, and I think by going out and seeing it and identifying it and beginning to communicate with it is the most rapid way to create a product.

However, in parallel with that, one needs to go ahead and propel up the people who are going to occupy the institutions and provide the focus, the academic focus, so that rehabilitation science and sciences have a credibility at the institutional level, which in most institutions, they, frankly, do not have now.

DR. RAUB: Any other takers around the table?

DR. KORN: You know, it would be fun, I suppose, if somebody could put together a couple of examples of what a desirable training program curriculum might look like for the kinds of products that you all seem to have in your heads at least, desirable outcomes.

It would help me, at least, to understand

how you're thinking more concretely about the sorts of experiences or training or whatever that you would regard as preparing somebody for what I would take as an academic track on what you're talking about. That might be a useful exercise just for illustrative purposes.

DR. RAUB: Dr. Nowell?

DR. NOWELL: Yes. I would second that. I am having trouble envisioning a training program that covers the whole spectrum from two of the areas that have been emphasized here as needs.

That is, one is the application of modern biomedical science to these problems, and then the second is the evaluation of problems as they exist now in individuals and the outcomes of current interventions, which is a quite different end point.

And I would also like to get a couple of specific examples of what such a training program might encompass.

DR. EDGERTON: My first priority, I think, would be to support M.D./Ph.D. programs. And I think there needs to be a program that is interdepartmental,

interdisciplinary, probably, one that would involve the department of physiology, department of anatomy, and so forth.

I don't think we should assume that any one program is going to solve all of these problems that we have been talking about, but there can be significant progress made in musculoskeletal problems, for example. There are a number of universities that can develop very strong programs that would involve clinical and basic research.

I think it's pretty clear that Dr. Cole and myself and the whole panel have been thinking about this a lot, but, frankly, I have been wanting to get to the point where I am convinced that I could encourage someone to spend the effort to develop a curriculum in medical rehabilitation.

And, as I said before, right now, based on my past experience, I could not encourage a young person to expect a productive career in this area. I think it is possible, but there has to be a commitment in funds.

DR. RAUB: Dr. Cole?

DR. COLE: I think the suggestion that there be an exercise to develop a model curriculum is an excellent suggestion, and I hope that the subsequent meetings of panels and groups do address this.

I think that when and if this comes to pass and becomes developed enough so that a group like this could convene around a table again and say "Look what we have wrought. Let us evaluate it," what one would find is that at Institution "X," the focus would be different than at Institution "Y." Yet, they both would be rehabilitation, much as we have now.

If we look at departments of, let us say, neurology, clearly, depending upon what department you're looking at, you'll see a strength in this or that aspect of neurology. I expect the same would happen in the broad field of rehabilitation.

DR. RAUB: In other areas we found it useful to make a formal solicitation. In this case I could envision characterizing, in broad terms at least, the kinds of training environments and perhaps selected topics that one might encourage and then

challenge the community to respond to that. Is that realistic, from your point of view?

DR. COLE: I think it is.

DR. RAUB: Even this year?

DR. COLE: Even this year. I would ask and expect you to hold the feet of the rehabilitation community to the fire. I think that they would like you to do that, in fact.

I think they would respond much as we saw the panel respond. It was described as unflagging effort towards a product. And I think the enthusiasm of the rehabilitation community is higher than I have ever seen it.

Perhaps I could help to put a cap on this by saying, as one member of the rehabilitation science community, I am deeply indebted to the NIH's effort. I have been in the field for 30 years, and I have never seen such a comprehensive, thorough, deep, and seeking effort made to understand this complex, fuzzy field of rehabilitation and to bring it into focus.

I will speak for the field and say we are deeply indebted. I thank all of you for this

attention and effort, and I look forward to the next several years.

DR. EDGERTON: I think a request for specific proposals, announcement of opportunity, this is the kind of leadership that I think can result into something very rapidly.

MR. NICHOLS: Bill, were you suggesting that if you made such an RFP, that you might make no awards or a lot of awards or only a few starter awards or what were you getting at?

DR. RAUB: By definition, the way we use the request for applications is that we tentatively put some money aside in the hope that there will be respondents out there with challenging ideas that will give us more than enough in terms of what we're looking for and, therefore, the opportunity to select among the very best.

At the other extreme, there have been instances where the responses to such a solicitation were sufficiently disappointing that we had no obligation to follow through and didn't.

My sense is we would not be in that latter

category here, but there could be the opportunity for a provocative challenge to the field and ourselves if we could focus on some very specific areas.

And I take the thrust of the discussion being in some aspects that research training and career development would be a particularly timely target.

MR. NICHOLS: But they would be in competition. This special competition would be in competition with the larger NIH dynamics that are going on that we would be getting to shortly.

DR. RAUB: As always. Dr. Cole mentioned complex and fuzzy. We specialize in complex and fuzzy.

MR. NICHOLS: You're in the right city.

DR. RAUB: Would anyone like the last word on this topic?

(No response.)

If not, may I take the thrust of the discussion this morning as an endorsement in principle for the recommendations of the task force here and, with God speed, to Dr. Alexander as he seeks to

integrate this, as you focus on these activities.

We're running ahead of schedule, but I think usefully so. Let's take our break now, try to get back by about 10:15, and then we'll take up the topic with respect to financial management.

(Whereupon, the foregoing matter went off the record at 9:56 a.m. and went back on the record at 10:24 a.m.)

DR. RAUB: If everyone will take his or her seat, we're ready to resume. Dr. Moskowitz has put a taxi request in front of me.

(Laughter.)

DR. RAUB: He's always very perceptive.

NATIONAL INSTITUTES OF HEALTH

SUPPORT FOR MEDICAL REHABILITATION RESEARCH

BASIC AND CLINICAL RESEARCH TRAINING

FISCAL YEAR 1989

FY 1989 MEDICAL REHABILITATION RESEARCH SUPPORTED BY THE NIH

BASIC AND CLINICAL RESEARCH TRAINING

		EXTRAMURAL		INTRAMURAL		
	TOTAL $	MAJOR	MINOR	MAJOR	MINOR	# GRANTS
NINDS	129,075	129,075	--	--	--	2
NIA	327,961	274,775	53,186	--	--	6
NCI	379,482	379,482	--	--	--	9
NICHD	55,409	55,409	--	--	--	1
NCNR*	12,500	--	12,500	--	--	3
NIAMS	376,008	376,008	--	--	--	6
NIDCD	385,877	385,877	--	--	--	6
CC	31,200	--	--	31,200	--	--
TOTAL	1,697,512	1,600,626	65,686	31,200		33

*NCNR has 3 active training awards, but only one received funds from FY 1989 allocations.

CRISP REPORT FORMAT F...

-PROJECT NUMBER.....5K08NS01162-03

IRG/INTRAMURAL UNIT..NSPA
AWARD AMOUNT.....$74,229

INSTITUTION.....DUKE UNIVERSITY

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DURHAM, N C 27710

TITLE Biochemical receptor studies in stroke (rats, rabbits)

Catecholaminergic systems have been implicated in both the pathogenesis of stroke and the recovery of function after ischemic injury. This proposal is designed to further elucidate the structure, regulation and function of the a1-adrenergic receptor (a1-AR) for catecholamines. a1-AR mediated events may play a role in the control of the cerebral circulation in man. In addition, the a1-AR may directly influence cellular metabolism through the putative second messengers inositol trisphosphate and diacylglycerol. This may be important for the understanding of neuronal growth, plasticity and altered neurotransmission.

The work has three specific aims: 1) to develop technologies for the purification of the necessary quantities of receptor protein, 2) to raise antibodies directed against the a1-AR and, 3) to develop a system for the reconstitution of the a1-AR into phospholipid vesicles.

Purification of the receptor protein will be accomplished through sequential affinity chromatography, wheat germ agglutinin chromatography, and high performance steric-exclusion liquid chromatography. Purified receptor will then be employed to immunize rabbits for the production of antibodies. A reconstitution system will provide a means of assaying the activating function of the receptor and a way of studying the mechanisms by which the receptor-effector system is regulated.

Combined with previous work, the availability of these biochemical tools will permit further study of the a1-adrenergic receptor at the molecular level.

-PROJECT NUMBER.....2K04NS00942-05

PI ADDRESS
ROSENBAUM, DAVID A
UNIV OF MASS
DEPT OF PSYCHOLOGY
AMHERST, MA 01003

IRG/INTRAMURAL UNIT..CMS
AWARD AMOUNT.....$54,846

INSTITUTION.....HAMPSHIRE COLLEGE
TITLE Cognitive control of movement (human)

The principal investigator will intensify and expand his basic research on the cognitive events that precede and allow for the performance of voluntary movements, and he will apply the research to the analysis of movement disorders. Toward fulfillment of the clinical objective, he will audit courses and engage in clinical research with two or more neurologists.

Five projects will be pursued:

(1) Planning of aimed hand movements. The aim of this new experimental procedure is to determine how people plan a series of aimed hand movements immediately after seeing a display specifying the targets to which movements must be aimed.
(2) Cognitive control of movement sequences. This project is the proposed renewal of the PI's NSF grant and consists of two parts: (a) The three-dimensional analogue of project (1) above, where the focus is on planning reaching and manipulation, both in normal and clinical (especially apraxic) populations; (b) Analysis of two recently discovered motor "illusions" that shed light on the mechanisms of serial ordering of behavior.
(3) Internal representation of the body surface. By having subjects perform a new speeded discrimination task in which all possible pairs of test sites serve as targets and distractors, the data can be analyzed with multidimensional scaling to allow for "visualization" of the body representation. Pilot work has turned up effects of handedness and posture.
(4) A book. A textbook, "Human Movement Control," will be written. The book will provide an overview of research and treatment pertaining to each of the major activity systems (e.g., Walking, Looking, Speaking, Writing, Reaching and Grasping.
(5) Cognitive Darwinism. Darwin's theory of natural selection will be applied to cognitive function. The key notion is that spontaneous variation in cognitive structures may provide a basis for generalization, preparation, and other important phenomena.

REPORTING FORM #2

ICD: NIA

PROJECT TITLE: Identifying Fall Related Factors

IDENTIFY SCIENCE AREA/TRAINING: Research and Clinical Training

MAJOR/MINOR EMPHASIS: Major

PRINCIPAL INVESTIGATOR: Mary E. Tinetti

INSTITUTION: Yale University

PROJECT NUMBER: 5 K08 AG00292-05

FY 1989 AWARD AMOUNT (associated with medical rehabilitation research): $61,544

ABSTRACT:
The major research project is the first prospective study of fall related factors in a sample of independently living elderly persons. The study, which involves an initial evaluation, a fall diary, bimonthly phone contact, and a partial reevaluation will examine the relative roles of chronic disabilities, acute stresses, and environmental hazards in fall etiology.

Two other future fall related projects include a fall intervention trial based on the results of the upcoming study and a project addressing the problem of fear of falling. Substudies from the data generated in the major project are also anticipated.

Examples of other age related research projects at Yale University include: the Yale Health and Aging Project (Drs. Ostfeld and Berkman), development of resource utilization groups for LTC (Drs. Cooney and Smits), and an observational study of indwelling catheters in nursing homes (Dr. Miller). Also, Dr. Feinstein, with the help of the geriatric group, will be applying his clinimetric skills to the area of functional assessment.

Clinical and teaching opportunities (which are coexistent in large part) include, but are not limited to: the acute rehabilitation unit at Yale New Haven Hospital, the geriatric evaluation clinic, medical consultation at a LTC facility, and attending at several Yale affiliated hospitals.

Plans for the next few years include expansion of the geriatric clinic into a multidisciplinary evaluation clinic, development of a geriatric fellowship, and increased collaboration with other university and community people interested in aging from ethical, medical, economic, nursing, social, and basic science perspectives.

The applicant's strength lies in the association with, and support from, the excellent clinical epidemiology group (including the sponsor Dr. A. Feinstein), the Public Health and Epidemiology faculty interested in aging (Drs. Ostfeld, L. Berkman, and H. Smits), and the small but strong geriatric subdivision within the General Medicine Section (Drs. L. Cooney, R. Miller, and applicant). The applicant completed a geriatric and clinical epidemiology fellowship at the University of Rochester before

-PROJECT NUMBER.....5 K08 AG00292-05 (Continued)
joining the Yale faculty. During that fellowship she designed and conducted a preliminary fall study. In addition, geriatrics at Yale has a strong commitment from Dr. Thier, chairman of the Department of Medicine.

REPORTING FORM #2

ICD: NIA

PROJECT TITLE: Behavioral vs. Drug Intervention for Urinary Incontinence

IDENTIFY SCIENCE AREA/TRAINING: Research and Clinical Training

MAJOR/MINOR EMPASIS: Major

PRINCIPAL INVESTIGATOR: Kathryn L. Burgio

INSTITUTION: University of Pittsburgh

PROJECT NUMBER: 1 K04 AG00431-01A1

FY 1989 AWARD AMOUNT (associated with medical rehabilitation research): $45,100

ABSTRACT:

Urinary incontinence in the elderly is a major problem with significant medical, psychological, and social consequences. Previous research on urge incontinence, a common form of incontinence, has demonstrated that behavioral interventions and drug treatments are effective for many individuals. However, it is clear that no one method has been 100% effective and all methods have disadvantages.

This project will be a prospective, randomized trial comparing the effects of behavioral training, drug therapy (oxybutynin) and placebo on urge incontinence in ambulatory, community-dwelling women aged 55 years and older. Although the two treatments have been studied individually, their effects have never been compared. Approximately 390 women will be evaluated for participation with the expectation that 195 will complete the protocol. Stratified and blocked randomization procedures will be used to assign subjects to 4 sessions (8 weeks) of biofeedback-assisted behavioral training, 4 sessions (8 weeks) of treatment with oxybutynin, or 4 sessions (8 weeks) of placebo. The study will also evaluate the combined effects of the two interventions and characterize patients on clinical variables that may influence outcome.

The candidate was a fellow at the Gerontology Research Center, N.I.A. or six years during which time she focused her research on the development and testing of behavioral methods for the treatment of urinary and fecal incontinence. In her new position as Director of Research at the Benedum Geriatric Center at the University of Pittsburgh, Department of Medicine, she plans to extend her research on incontinence. Her short term goals are to further evaluate and improve treatment methods for incontinence. Her long range career goals involve continued investigations of urinary incontinence in collaboration with faculty and fellows in geriatrics, nursing, neurology, urology, rehabilitation and gynecology. She hopes to establish herself as an expert in the field of incontinence, and to expand her research to other problem areas in behavioral geriatrics.

REPORTING FORM #2

ICD: NIA

PROJECT TITLE: Geriatric Leadership Academic Award

IDENTIFY SCIENCE AREA/TRAINING: Research and Clinical Training

MAJOR/MINOR EMPHASIS: Major

PRINCIPAL INVESTIGATOR: Jacob A. Brody

INSTITUTION: University of Illinois, Chicago

PROJECT NUMBER: 5 K07 AG00384-05

FY 1989 AWARD AMOUNT (associated with medical rehabilitation research): $81,623

ABSTRACT:

The University of Illinois is seeking the Academic Leadership award as part of a series of initiatives to improve and enhance the geriatric and gerontology research presence within the University of Illinois system. Dr. Brody, during his career as a member of the commissioned corps of the United States Public Health Service, developed a distinguished reputation in a number of epidemiologic research endeavors, including slow viruses, alcoholism and aging. As the first Associate Director of the Epidemiology, Demography and Biometry Program of the National Institute on Aging, Dr. Brody developed an international reputation for his studies in aging. During his time as Director of EDBP, Dr. Brody conducted studies on Alzheimer's Disease (the New Haven and East Boston Studies) as well as studies on the functional, physical and mental status among the aged in the Framingham, Massachusetts and Honolulu, Hawaii longitudinal studies. Additionally, Dr. Brody helped to expand the federal data base on the aging, and because of his knowledge in this area, helped to direct the development of a macro-economic model for planning and detection of trends in health care and costs. This grant will permit Dr. Brody to concentrate his expertise by allowing him to devote energy to the expansion and development of collaborative research at the University of Illinois. Among the research projects which are planned as part of this development are a Data Analysis Unit, which will invest its energy in the analysis of large national Federal and non-Federal data sets, as a means of improving our understanding of the aging process. Additionally, Dr. Brody plans to participate in studies within the School of Medicine focusing on bone metabolism, osteoporosis and hip fracture, as well as the effects of rehabilitative medicine on the aged. Dr. Brody will also work toward establishing collaborative relationships with other schools and colleges within the University, such that these additional units will also begin to invest time and energy in research on the aging. Further, Dr. Brody will move to develop a research training grant which will seek fellows from across the various schools and colleges of the University. These fellows will be encouraged to develop collaborative research projects which will combine the various

-PROJECT NUMBER.....5 K07 AG00384-03 (Continued)

basic sciences with the behavioral sciences, the clinical sciences and the humanities. Through this effort, the University of Illinois hopes to develop a unique gerontology and geriatric research presence focused on helping the aging improve their quality of life.

REPORTING FORM #2

ICD: NIA

PROJECT TITLE: Exercise Conditioning in Older Coronary Patients

IDENTIFY SCIENCE AREA/TRAINING: Research and Clinical Training

MAJOR/MINOR EMPASIS: Major

PRINCIPAL INVESTIGATOR: Philip A. Ades

INSTITUTION: University of Vermont

PROJECT NUMBER: 5 K08 AG00426-02

FY 1989 AWARD AMOUNT (associated with medical rehabilitation research): $67,608

ABSTRACT:

The studies detailed in this research plan are designed to prospectively investigate the magnitude and mechanism of the physiologic adaptations that occur when older patients with coronary heart disease (CHD) participate in a 3-month and a 12-month program of aerobic exercise conditioning. A control group will consist of nonexercising older CHD patients. Central to this project is the capacity of CHD patients, age 62 years and older, to adapt to an aerobic exercise program with an increase of maximal aerobic capacity as measured by maximal exercise oxygen consumption, and by an increase submaximal endurance capacity as measured by an exhaustive submaximal exercise protocol. Submaximal indices of conditioning, such as heart rate-blood pressure product and blood lactate concentration at a given workload, will also be emphasized as they are applicable to daily activities. Cardiac adaptations to training will include radionuclide ventriculographic indices of left ventricular performance, corrected for measures of ventricular loading conditions, as well as measures of submaximal and maximal exercise heart rat-blood pressure product, and index of myocardial oxygen demand. Peripheral adaptations to training will include measures of post-ischemic exercise calf blood flow and conductance and muscle biopsy sample for determination of capillarity and oxidative enzyme activity and glucose stores. Blood lactate determination during the exhaustive submaximal endurance protocol will assess adequacy of skeletal muscle oxygenation during exercise.

Preliminary data from our laboratory suggests that older CHD patients obtain a similar relative training benefit as younger CHD patients yet are far less likely to participate in an organized cardiac conditioning program. Entry level data (clinical, demographic, psychosocial) will be analyzed to determine predictors of participation and nonparticipation in an exercise-based rehabilitation program for older coronary patients.

REPORTING FORM #2

ICD: NIA

PROJECT TITLE: Aging with a Disability: The Late Effects of Polio

IDENTIFY SCIENCE AREA/TRAINING: Research and Clinical Training

MAJOR/MINOR EMPASIS: Major

PRINCIPAL INVESTIGATOR: Jessica Scheer

INSTITUTION: National Rehabilitation Hospital, Washington, D.C.

PROJECT NUMBER: 5 F32 AG05447-02

FY 1989 AWARD AMOUNT (associated with medical rehabilitation research): $14,000

ABSTRACT:

No Abstract Available

REPORTING FORM #2

ICD: NIA

PROJECT TITLE: Natural History and Folk Etiology of Age-Related Disorders

IDENTIFY SCIENCE AREA/TRAINING: Research and Clinical Training

MAJOR/MINOR EMPHASIS: Minor

PRINCIPAL INVESTIGATOR: Linda S. Mitteness

INSTITUTION: University of California, San Francisco

PROJECT NUMBER: 5 K04 AG00274-05

FY 1989 AWARD AMOUNT (associated with medical rehabilitation research): $53,186

ABSTRACT:

The proposed research program will further the development and testing of hypotheses concerning the management of age-related diseases. These hypotheses depend on careful contextual description of the natural histories of age-related diseases and the analysis of folk etiologies or explanatory models held by both laymen and professionals. This research has begun with an investigation of the behavioral contexts of urinary incontinence among the relatively healthy community-living elderly.

The proposed next step of the research program is the description and analysis of the natural history of urinary incontinence among the frail, homebound elderly. The research program will then be extended in two directions: expansion of the hypotheses developed through the analysis of urinary incontinence to other age-related disorders, and testing of these hypotheses through intervention research that focuses on both behavior change and change of folk etiologies held by elderly patients and their health providers. The initial expansion of the basic research component of the research program will be an examination of doctor-patient communications surrounding age-related disorders. The intervention component of the research program will include clinical trials of behavioral interventions for stress incontinence and mixed-etiology stress incontinence among elderly women. This research will examine both patient and provider behavior change and the effect of each on the effectiveness of treatment of stress incontinence.

In order to achieve the goals of this research program, the researcher will combine the ongoing research tasks with certain training components. First, she will obtain further training in the basics of human anatomy, physiology, and pathology. The second area of knowledge acquisition will be in methodological and theoretical aspects of sociolinguistics, in preparation for the analysis of doctor-patient communication. The third activity that is vital preparation for this research program will focus on the research groundwork necessary for the design of observational research in the clinical setting. This will include attention to logistical, ethical and methodological constraints of this particularly difficult research site as well as the further development of collaborative research ties with geriatricians.

ICD: National Cancer Institute

PROJECT TITLE: Biobehavioral Control of Chemotherapy Side Effects

IDENTIFY SCIENCE AREA/TRAINING: Rehabilitation Training

MAJOR/MINOR EMPHASIS: Major - 100%

PRINCIPAL INVESTIGATOR: Gary R. Morrow

INSTITUTION: University of Rochester

GRANT NUMBER: K04 CA01038-05

FY 1989 AWARD AMOUNT: $49,692

ABSTRACT:

This research is directed toward optimizing currently available behavioral interventions for side effect control, developing a new technology for nausea assessment and increasing understanding of side effect etiology.

ICD: National Cancer Institute

PROJECT TITLE: Articulatory Dynamics in Orofacial Cancer Patients

IDENTIFY SCIENCE AREA/TRAINING: Rehabilitation Training

MAJOR/MINOR EMPHASIS: Major - 100%

PRINCIPAL INVESTIGATOR: Rebecca Leonard

INSTITUTION: University of California, Davis

GRANT NUMBER: K04 CA01125-03

FY 1989 AWARD AMOUNT: $53,568

ABSTRACT:

The intent of this project is to describe thoroughly the speech characteristics of a wide variety of orofacial cancer patients, including those with partial or total glossectomy, mandibulectomy, maxillectomy and/or more extensive facial excisions. Data obtained from analyses of acoustic, aerodynamic, biomechanical and perceptual characteristics of speech in these patients will provide the basis for attempts to model both the nature and degree of speech impairment in orofacial cancer. It is expected that information resulting from these studies will direct the formulation of principles useful to the prognostic and therapeutic management of speech rehabilitation in this patient population.

ICD: National Cancer Institute

PROJECT TITLE: Behavioral Intervention for Children with Cancer

IDENTIFY SCIENCE AREA/TRAINING: Rehabilitation Training

MAJOR/MINOR EMPHASIS: Major - 100%

PRINCIPAL INVESTIGATOR: Lonnie K. Zeltzer

INSTITUTION: University of California at Los Angeles

GRANT NUMBER: K04 CA01268-06

FY 1989 AWARD AMOUNT: $52,272

ABSTRACT:

This grant has enabled the investigator to continue a number of her studies. One part of her efforts focused on an intervention study of nausea and chemotherapy-related distress in children. Another part examined family factors contributing to children's reactions to the stress of treatment. A new pilot study will be undertaken to assess the roles of the biologic basis of temperament and parent/child interaction in children's response to stress.

ICD: National Cancer Institute

PROJECT TITLE: Behavioral Correlates of Cancer Pain

IDENTIFY SCIENCE AREA/TRAINING: Rehabilitation Training

MAJOR/MINOR EMPHASIS: Major - 100%

PRINCIPAL INVESTIGATOR: Diana J. Wilkie

INSTITUTION: University of California, San Francisco

GRANT NUMBER: F31 CA08256-04

FY 1989 AWARD AMOUNT: $12,500

ABSTRACT:

The general focus for this doctoral research program is the interaction of the psychosocial behavioral aspects with biological parameters of cancer pain.

ICD: National Cancer Institute

PROJECT TITLE: Optimizing Cognitive Function in Patients with Cancer

IDENTIFY SCIENCE AREA/TRAINING: Rehabilitation Training

MAJOR/MINOR EMPHASIS: Major - 100%

PRINCIPAL INVESTIGATOR: Bernadine E. Cimprich

INSTITUTION: University of Michigan

GRANT NUMBER: F31 CA08390-03

FY 1989 AWARD AMOUNT: $12, 500

ABSTRACT:

The purpose of the proposed doctoral research is to study conditions which influence the differential use of attention processes during chronic or life-threatening illnesses.

ICD: National Cancer Institute

PROJECT TITLE: Is Visual Imagery an Adjunctive Cancer Therapy?

IDENTIFY SCIENCE AREA/TRAINING: Rehabilitation Training

MAJOR/MINOR EMPHASIS: Major - 100%

PRINCIPAL INVESTIGATOR: Janice E. Post-White

INSTITUTION: University of Minnesota

GRANT NUMBER: F31 CA08430-02

FY 1989 AWARD AMOUNT: $12,500

ABSTRACT:

This is an ambitious doctoral research program to investigate the effect of mental imagery on immune function and cancer outcome.

ICD: National Cancer Institute

PROJECT TITLE: Spirituality and Meaning of Life in Cancer Patients

IDENTIFY SCIENCE AREA/TRAINING: Rehabilitation Training

MAJOR/MINOR EMPHASIS: Major - 100%

PRINCIPAL INVESTIGATOR: Elizabeth A. Johnston

INSTITUTION: University of Pennsylvania

GRANT NUMBER: F31 CA08431-02

FY 1989 AWARD AMOUNT: $12,500

ABSTRACT:

The purpose of this doctoral research is to capture the essence of spirituality, or at least one aspect of it (search for meaning) through an examination of patients' perceptions. The researcher has proposed using a phenomenological framework and methodology. This description of spirituality and meaning in life will encourage further research as well as provide a guide to nurses working in this area.

ICD: National Cancer Institute

PROJECT TITLE: Perception of Support in Parents of Children with Cancer

IDENTIFY SCIENCE AREA/TRAINING: Rehabilitation Training

MAJOR/MINOR EMPHASIS: Major - 100%

PRINCIPAL INVESTIGATOR: Holly A. Williams

INSTITUTION: University of Florida

GRANT NUMBER: F31 CA08681-02

FY 1989 AWARD AMOUNT: $0

ABSTRACT:

The two major aims of this doctoral research program are to gain more understanding about why certain families experiencing childhood cancer appear to have more social support than others and to use this understanding to help families maximize their social support.

ICD: National Cancer Institute

PROJECT TITLE: Psychiatric and Pain Research Training in Cancer

IDENTIFY SCIENCE AREA/TRAINING: Rehabilitation

MAJOR/MINOR EMPHASIS: Major - 100%

PRINCIPAL INVESTIGATOR: Jimmie C. Holland

INSTITUTION: Memorial Hospital for Cancer & Allied Diseases

GRANT NUMBER: T32 CA09461-06

FY 1989 AWARD AMOUNT: $173,950

ABSTRACT:

This award represents the NCI's only ongoing research training grant in the area of pain and the psychological aspects of cancer. The principal preceptors of this grant are Doctors Holland, Foley and Sidtis. The training tracks, which often overlap, are in pain research, with projects concentrating on pharmacologic or clinical aspects, in psychiatric studies exploring the impact of cancer and its treatment on patients' and their families' psychological and biological function, and in neuropsychology studies assessing the cognitive and neurophysiologic effects of cancer and its treatment.

NICHD TRAINING GRANTS IN REHABILITATION (EXCL MRDD), FY 1989

07285 04

5 T32 HD07285 04	RESEARCH TRAINING PROGRAM IN BEHAVIORAL PEDIATRICS		HLB		
ALTEMEILR, WILLIAM A	VANDERBILT UNIVERSITY		NASHVILLE, TENNESSEE	FY: 89	$55,409
(**07285 04		1	$55,409		
(**GRAND TOTAL		1	$55,409		

07032 12

5 T32 HD07032 12 MENTAL RETARDATION MRDD
BUCHWALD, NATHANIEL A UNIVERSITY OF CALIFORNIA LOS ANGELES LOS ANGELES, CALIFORNIA FY: 89 $177,981
(**07032 12 1 $177,981

07176 10

5 T32 HD07176 10	MENTAL RETARDATION RESEARCH TRAINING IN PSYCHOLOGY	MRDD	FY: 89	$106,703
DETTERMAN, DOUGLAS K	CASE WESTERN RESERVE UNIVERSITY	CLEVELAND, OHIO		
**07176 10	1 $106,703			

07184 11

2 T32 HD07184 11 MENTAL RETARDATION MRDD
BORKOWSKI, JOHN G UNIVERSITY OF NOTRE DAME NOTRE DAME, INDIANA FY: 89 $83,918
1 $83,918
**07184 11

07226 11

2 T32 HD07226 11 RESEARCH BEHAVIORAL SCIENTISTS IN MENTAL RETARDATION MRDD FY: 89 $159,968
WARREN, STEVEN F VANDERBILT UNIVERSITY NASHVILLE, TENNESSEE
**07226 11 1 $159,968

NICHD MRDD TRAINING PROJECTS ON REHABILITATION, FY 1989

07262 06

2 T32 HD07262 06 ELLIS, NORMAN R	MENTAL RETARDATION UNIVERSITY OF ALABAMA IN TUSCALOOSA		MRDD TUSCALOOSA, ALABAMA	FY: 89	$53,210
*07262 06	1	$53,210			
*GRAND TOTAL	5	$581,780			

REPORTING FORM #2

ICD: NCNR

PROJECT TITLE: Quality of Life in Cardiac Rehabilitation Patients

IDENTIFY SCIENCE AREA/TRAINING: Research and Clinical Training

MAJOR/MINOR EMPHASIS: (Expected to be major)

PRINCIPAL INVESTIGATOR: Lazar, Nanci C.

INSTITUTION: Rush University

PROJECT NUMBER: F31 NR06130

FY 1989 AWARD AMOUNT (associated with medical rehabilitation research): $0

ABSTRACT:

Purpose of the study is to provide a descriptive foundation regarding what connotes issues of quality of life for the cardiac rehabilitation patient population. The applicant bases the need for the study on the importance of determining quality of life in outcome studies of rehabilitation programs. A review of the literature reflects various views of the construct "quality of life", primarily from literature of the late 1970's until the present, and the various tools. Plans are to examine quality of life as it relates to life events, decision making, subsequent interventions and the general recovery from chronic cardiovascular disease. The applicant expects to use both qualitative and quantitative methods. (Pre-doctoral award)

REPORTING FORM #2

ICD: NCNR

PROJECT TITLE: Spinal Cord Injury Patients, Nursing Environment and Care

IDENTIFY SCIENCE AREA/TRAINING: Research and Clinical Training

MAJOR/MINOR EMPHASIS: (Expected to be major)

PRINCIPAL INVESTIGATOR: Nelson, Audrey L.

INSTITUTION: University of Florida

PROJECT NUMBER: F31 NR06099

FY 1989 AWARD AMOUNT (associated with medical rehabilitation research): $0

ABSTRACT:

The purpose of the proposed research is to explore aspects of nursing environments on spinal cord injuries (SCI) units within VAMC which enhance or inhibit nursing care and patient outcomes. An organization analysis model will be used which looks at social system, technology, external environment, dominant coalition, formal organizational arrangements and employees. The applicant plans to use both qualitative and quantitative methods. Data will be collected through observations, interviews, questionnaires, and a review of unit designs. The sample will be SCI units within the VA system. (Pre-doctoral award)

REPORTING FORM #2

ICD: NCNR

PROJECT TITLE: Recognizing Depression Following Stroke

IDENTIFY SCIENCE AREA/TRAINING: Research and Clinical Training

MAJOR/MINOR EMPHASIS: Minor

PRINCIPAL INVESTIGATOR: Whitney, Fay

INSTITUTION: University of Pennsylvania

PROJECT NUMBER: F31 NR06187

FY 1989 AWARD AMOUNT (associated with medical rehabilitation research): $12,500

ABSTRACT:

The purpose of the proposed study is to characterize depressive signs and symptoms experienced by strike patients at different points in time throughout recovery. The specific aims are: 1) to characterize signs and symptoms of stroke patients with lesions at different sites; 2) to examine the relationships among site of the lesion, time since the stroke and depressive signs and symptoms over time, and 3) to explore differences in caregiver and family perceptions of patient depression.

A prospective, longitudinal design will be employed to characterize post-stroke depressive responses in a convenience sample of 386 stroke patients. Four hospitals will be used as a source of patients who will be studied at two weeks, 3 months and 6 months after stroke. A standardized battery of tools (Beck Depression Scale, MAACL-R, Zung), and an investigator developed measure (Comprehensive Mood Index: CMI) will be used to provide a comprehensive examination of the depressive signs and symptoms seen in these patients. Demographic, clinical, CT scan and functional outcome data will be used to describe the population, to locate lesion site, and to consider confounding variables relative to depression. Paired family members, and nurses caring for the patient will also be studied (using the CMI) to ascertain differences in perception of the presence and degree of depression the patient suffers.

Data analyses will include: 1) descriptive statistics to characterize the population studied and the depression in relation to site of lesion; 2) multivariate techniques with repeated measures to examine the relationship of site of the lesion and length of time since the stroke to depression followed by univariate analyses if significant differences are found, 3) multivariate analyses with repeated measures to examine differences in perceptions of depression between patients, nurses and family work will provide clinicians caring for stroke patients with information which will assist them in detecting depression in these patients so that referral and treatment are more accurate. This can lead to increased quality of life for these patients and their families.

DETAILED DESCRIPTION OF RESEARCH TRAINING PROGRAM

1. GENERAL OVERVIEW

The UCLA program amphasizes the great need for both basic and applied clinical research in the field of total-joint replacements and skeletal implants. As such, the research interests span areas extending from the study of the physical interactions between opposing man-made articulating surfaces to the biological response of bone to dynamically-loaded skeletal implants. The aim in this program is to bring together the necessary expertise to attack the problem in the clinical setting. In this way the rea problems and limitations involved in patient care are realistically and continuously being re-evaluated. This is an essential part of any bioengineering training program, whether it is approached from the clinical or engineering disciplines.

2. FACULTY

The senior clinical faculty involved in this program includes Drs. Amstutz, Cracchiolo and Finerman, with additional support provided by Dr. Moreland (Junior Staf Surgeon) and Dr. Mirra (Assistant Professor, Pathology). The Biomechanics Research Section within the Division of Orthopedics is engaged full-time in research and clinical development work involving various aspects of the total-joint replacement program at UCLA. This faculty group includes two engineers with considerable experience and knowledge in laboratory supervision, teaching and research, K. Markolf, Ph.D. and I. Clarke, Ph.D. They are very ably supported in these by two research engineers, H. McKellop, M.S. and Al Hodgson, M.S., with support from the biological side by T. Gruer M.S. (Staff Research Associate). The various research projects currently being developed by these individuals are well illustrated in the bibliography.

3. FACILITIES

Center for Health Sciences: This center includes the clinical, surgical and radiograph facilities of the orthopedic division within a large modern research hospital. Included in the orthopedic suite is a specialized histopathological laboratory under the responsibility of Dr. J. Mirra. This is currently equipped with a Faxitron x-ray system, a Trimatic automatic tissue processor, tissue band-saw, Spencer microtome H.I. microtome-blade sharpener, P.S. processing oven and freezer/refrigerator facilities. The microscopic facilities include a Leitz system with transmitted/reflected light facilities, polarizing and fluorescing modes and integral photometer system.

The microscopic facilities in our Biomechanics Research Section under the responsibility of Dr. Clarke include a Bausch and Laumb stereo microscope/camera unit, a Natchet system with transmitted/reflected-light facilities, polarizing, differential interference-contrast and interferometry modes with Nikkon photometer and camera system. The scanning electron microscope (Cambridge Stereoscan Mk IIa) with an x-ray analyzer (Kevex Corp.) attachment is located in the Materials Science Dept. on campus.

The Biomechanics Research Section (Director, Dr. Markolf) also includes a well-equipped machine shop, an electronics and instrumentation laboratory and a materials evaluation laboratory containing an MTS Model 812 servohydraulic materials testing machine. This machine can achieve actuator velocities of up to 50 inches/sec for single cycle load applications. The maching is capable of stroke control (for failure testing) or load control (for fatigue testing). Failsafe options provide for system shutdown when the specimen fractures or when the load falls below a predetermined lev Associated oscilloscope (with camera) or x-y plotter consoles are available for recor ing tests data. Conventional back-up facilities, equipment and supplies are available for the preparation and mechanical evaluation of connective tissues and bones.

The research activities also routinely utilize the Division of Animal Surgery Laboratories (H. Frankenberg, Center for Radiological Research (H. Snow, D.V.M., Direc facilities in the Department of Radiological Sciences/Nu Director) and the Prosthetics-Orthotics Educational Prog Bray, P.O.).

CLINICAL TRAINING

X MAJOR ___ MINOR

REHAB $ 66530

DESCRIPTION: State the application's broad, long-term objectives and specific aims, making reference to the health relatedness of the pro Describe concisely the experimental design and methods for achieving these goals. Avoid summaries of past accomplishments and the of the first person. This abstract is meant to serve as a succinct and accurate description of the proposed work when separated from application. DO NOT EXCEED THE SPACE PROVIDED.

The purpose of the UCSD Residency Training Program continues to be to provi training for the practice of general orthopaedic surgery but also to provide the necessary training for inclusion of academic orthopaedics within the range of career choices of graduates. The Training Grant program is designed to meet the training needs of postdoctoral trainees in both Orthopaedics and Biomechanics. Selection of residents at this institution is biased toward applicants with academic goals. The clinical program strengths beyond general orthopaedics and fractures include: children's orthopaedics, rehabilitation, implant surgery, amputee rehabilitation, spine surgery, sports medicine, and hand surgery.

The scope of research training includes biomechanics, biochemistry, morphology, and muscle physiology, and interstitial fluid mechanics. Emphasis is on interdisciplinary collaboration on projects with ultimate or immediate clinical relevance. Neurophysiology will be added in the forthcoming year with the recruitment from UCLA of Dr. Sue Bodine-Fowler. Correlative coursework to each of these fields is available on the UCSD campus and such coursework will be tailored to the individual trainee's needs. A Master's and Ph.D. degrees are presently offered in Biomechanics.

Our goal is to maintain the necessary flexibility to provide the best training platform for bioengineers and orthopaedic residents so that the unmet personnel needs in academic orthopaedics can be narrowed. Flexibility is required to tailor a specific program to the particular needs and interests of each trainee. The diversity of faculty talents and interests available has allowed us to match the program with the trainee in most instances.

KEY PERSONNEL ENGAGED ON PROJECT

NAME, DEGREE(S), SSN	POSITION TITLE AND ROLE IN PROJECT	DEPARTMENT AND ORGANIZATION
W. H. Akeson, M.D. 480-24-7275	Professor/Program Director	Surgery/Orthopaedics
J. J. Abitbol, M.D. 603-14-4827	Assistant Adjunct Professor	Surgery/Orthopaedics
D. Amiel, Dip. Ing. 567-52-3991	Associate Adjunct Professor	Surgery/Orthopaedics
M. Botte, M.D. 564-80-6742	Assistant Professor (IR)*	Surgery/Orthopaedics
S. Bodine-Fowler, Ph.D. 556-17-2475	Assistant Professor (IR) (Proposed)	Surgery/Orthopaedics
F. R. Convery, M.D. 536-24-8912	Professor	Surgery/Orthopaedics
R. Coutts, M.D. 567-52-3991	Associate Adjunct Professor	Surgery/Orthopaedics
S.R. Garfin, M.D. 474-50-6565	Associate Professor	Surgery/Orthopaedics
D. H. Gershuni, M.D. 567-47-6846	Professor (IR)	Surgery/Orthopaedics
F. Golbranson, M.D. 538-36-2131	Clinical Professor	Surgery/Orthopaedics
M. Kwan, Ph.D. 053-64-2749	Assistant Professor (IR)	Surgery/Orthopaedics
R.L. Lieber, Ph.D. 554-70-9009	Assistant Professor (IR)	Surgery/Orthopaedics
V. Nickel, M.D. 541-14-5611	Clinical Professor	Surgery/Orthopaedics
D. Sutherland, M.D. 519-16-7322	Professor (IR)	Surgery/Orthopaedics
S. Woo, Ph.D. 552-62-1643	Professor	Surgery/Orthopaedics
E. Zinberg, M.D. 094-42-3338	Assistant Professor (IR)	

University of California
San Diego

*IR - in Residence

CLINICAL TRAINING

X MAJOR ___ MINOR

REHAB $ 34020

PHS 398 (Rev. 9/86)

in this application. X MAJOR ___ MINOR

3. Program Plan REHAB $ 138,302

This combined training program is specifically designed to train candidates with MD, PhD and predoctoral degrees who intend to pursue academic careers in basic research with application to clinical problems in disorders of the locomotor system. Training occurs through intensive participation in specific research projects, as well as participation in coursework, conferences and seminars (see Appendices 1, 2) sponsored individually or conjointly by the cooperating groups.

Postdoctoral fellows in rheumatology take a 36-month training program. Of the 36 months, 12 months are utilized for clinical training in the rheumatic diseases and are not supported by the training grant. The 24-month research training period is devoted to basic research with special, but not exclusive emphasis, in cell biology and biochemistry of cartilage, or in immunology.

The orthopaedic and tissue biomechanics training program selects both predoctoral and postdoctoral fellows to participate in a research program. The postdoctoral appointments in orthopaedic research are designed for one to three year periods of training, with multiple-year fellowships strongly recommended. Predoctoral appointments are for three years and require the intent on the part of the trainee to complete a PhD program in orthopaedic engineering. Each trainee selects a specific project and preceptor in areas of bone transplantation, immunology of bone/cartilage, cartilage cell biology and biochemistry, and tissue biomechanics as they apply to the musculoskeletal system.

Eight trainees (2 predoctoral, 6 postdoctoral) will be selected for the training grant program in a given year. Predoctoral candidates are integrated into the existing graduate program of the Department of Mechanical and Aerospace Engineering; three postdoctoral fellows will be appointed in rheumatology, and 3 postdoctoral trainees in orthopaedics. This mix varies depending on the goals of the candidates and projects in progress. Both predoctoral candidates, and postdoctoral trainees and fellows undertake laboratory research projects under the direct guidance of their sponsors. These projects provide extensive experience in a wide variety of current laboratory techniques in the biological areas, including cell culture, development and maintenance of cell lines, production and utilization of monoclonal antibodies, column chromatography, gel electrophoresis, thin layer chromatography, fluorescence microscopy, utilization of the fluorescence-activated cell sorter, and radioimmunoassay.

In the tissue biomechanics and orthopaedic areas, techniques available for the trainee to experience include: microvascular surgical techniques, mechanical property measurements of bone and cartilage, image analysis and morphometry, histologic techniques, immunologic concepts, calcium and collagen chemistry, animal surgical techniques, and computation and statistical evaluation utilizing state-of-the-art computer techniques.

Three types of program tracks are offered: (1) a postdoctoral fellowship in the rheumatic diseases for physicians who have completed a residency training program in internal medicine, for 2 to 3 years which will include

both course work and laboratory experience in arthritis; (2) a postdoctoral program for orthopaedic trainees designed to give postdoctoral fellows one or two research years of training and experience in both theoretical and applied problems in musculoskeletal diseases; and (3) a predoctoral program for graduate students who wish to acquire a PhD in tissue biomechanics, specifically oriented toward research in musculoskeletal diseases. These three defined tracks which emphasize physician traineeships do not exclude applicant PhD fellows for training in the Division of Rheumatology or Department of Orthopaedics.

Weekly laboratory meetings, formal lectures, grand rounds, seminars and conjoint conferences and research-related coursework are provided for all trainees (see Appendices 1, 2). In weekly laboratory meetings, week-to-week progress in experiments is reviewed. Formal lectures in the basic sciences of cell biology, biochemistry and immunology are also available through formal coursework, medical grand rounds, seminars by local and visiting faculty, and conjoint conferences with the collaborating programs. Further, weekly seminars in immunology in which CWRU and guest faculty present their research are scheduled. A weekly journal club in the Division of Rheumatic Diseases provides an ongoing update of the scientific literature in the above disciplines.

In addition, there are two series of weekly departmental research seminars, during which time each trainee presents the progress on his/her research to the entire research faculty of the musculoskeletal training units. During these sessions both formal and informal critiques of ongoing research are performed.

Weekly teaching conferences are held in clinical areas which have appropriate relationships to each one of the research areas. The trainees attend clinical conferences which are available both in the Department of Orthopaedics and the Division of Rheumatic Diseases (see Appendix). These conferences are designed to integrate both the clinical and basic sciences as they apply to musculoskeletal pathology. However, the individual trainee has limited patient responsibility, not to exceed 10% of total time during his/her tenure as a research trainee.

The monitoring of the curriculum and review of research projects are the responsibility of the co-directors and Steering Committee. Although it is not the charge of the committee to develop research proposals or to reject projects in progress, it is appropriate for this committee to review individual projects and to pass on their educational value to the trainee. In this regard, the committee serves as an advisor and advocate of the trainee in the project. Another endeavor of the committee is to monitor the progress of the trainee and to provide counseling whenever necessary. The trainee's advisor meets with him/her on a regular basis to discuss the research, and the committee also meets semi-annually with both the advisor and the trainee. The purpose of these meetings is to evalute the progress and maturation of the trainee and to assist the advisor in the development of a tailored program for each trainee.

In the case of postdoctoral research fellows in rheumatology, an interim objective examination covering the basic and clinical sciences is administered in order to evaluate the performance of these physicians. Each trainee with responsibilities in the Department of Orthopaedics is required to

take the Orthopaedic In-Training Examination. Post-test feedback sessions are an integral part of this process. The specific program is changed as deemed appropriate by these feedback sessions. Using these mechanisms, the Steering Committee and the advisor reach a judgment as to whether the trainee has made reasonable and sufficient progress in research endeavors. Since emphasis is given to bridging the basic and clinical sciences, the committee weighs heavily the capacity of the trainee to integrate and to apply basic techniques and concepts to disease-related research.

The predoctoral training program is designed to produce PhD's, which are firstly fully competent in the engineering discipline of applied mechanics. Secondly, the graduates are to develop a special expertise in the applications of the principles of applied mechanics to understanding the behavior of the musculoskeletal system and its problems. The third goal is to strengthen the commitment to an academic career involving musculoskeletal research, which the trainees must necessarily express in order to enter the program.

The typical predoctoral trainee is either a two or three year appointee, who has completed an MS program. Typically, this program has had a biomechanics emphasis and the candidate has been through either the Mechanical and Aerospace Engineering or Biomedical Engineering program. In order to have proficiency in mechanics, the typical postdoctoral trainee takes the following courses or equivalents: Elasticity, Advanced Dynamics, Experimental Stress Analysis, and Applied Mathematics. With this background, trainees typically then take at least one advanced course in both the Mechanics of Materials, e.g. Viscoelasticity or Plasticity; Dynamics, e.g. Advanced Dynamics II or Advanced Vibrations; and Advanced Mathematics. All trainees also take the three courses: Functional Anatomy, Biomechanics of the Musculoskeletal System, and Mechanics of Biological Continua. Beyond these courses, trainees take courses which suit their own research specializations and interests. These areas would ordinarily be one of the following: Continuum Mechanics, Structural Mechanics, Dynamics and Kinematics.

Academic regulations for the PhD program include a basic science requirement of 6 hours of courses in the math of basic science departments, and a breadth requirement of 12 hours of courses taken outside of the department and area of specialization.

The third area of training, in addition to the course work and dissertation research, is the participation in a variety of local seminars and meetings (see Appendix). Graduate students attend the weekly Locomotor Seminars and the weekly meetings of the Orthopaedic Engineering Laboratory. At these meetings, current research activities, including their own, are presented. The additional weekly meetings in the Orthopaedic Engineering Laboratories which they can attend are the Bone Biomechanics Seminar and the Musculoskeletal Motion Seminar, in which current topics from the literature are discussed. As well, the trainees have access to most of the clinical and basic science conferences for Orthopaedics and Rheumatology.

4. Trainee Candidates

Selection criteria which are used to judge candidates include: (a) intent to enter academic medicine or related research; (b) academic excellence; (c) academic and clinical performance during residency; (d) prior

research experience; and (e) letters of recommendation.

The admission requirements for matriculation into the program are as follows: 1) Predoctoral candidates: BS and/or MS in engineering; 2) Postdoctoral trainees in orthopaedics: MD/MD-PhD, commitment to academic and research career; 3) Postdoctoral fellow in rheumatic diseases: MD, completion of an approved residency in Internal Medicine, special interest in arthritis research.

Greater than 75% of all postdoctoral trainees come from the CWRU School of Medicine and the residency programs of the Departments of Medicine and Orthopaedics of University Hospitals of Cleveland. Of the 144 graduates of CWRU School of Medicine each year, a significant number choose to remain in the Cleveland area for postdoctoral training. There are 100 residents in the three-year program in internal medicine, which combines University Hospitals and the Wade Park Veterans Administration Medical Center. A three-year medical residency at Cleveland Metropolitan General Hospital includes 50 physicians. Approximately 90% of the residents leaving these clinical training programs choose a subspecialty, and the majority elect one to three years of laboratory experience in addition to the clinical specialty training.

With regard to formal applications for training, approximately 25 to 30 inquiries regarding rheumatology fellowship training are received each year. Of these, 10 to 15 applicants formally apply and are interviewed. Of those interviewed, 2 to 3 academic clinical candidates, and 1 to 2 research candidates are accepted per year at various levels.

The Department of Orthopaedics annually receives between 325 and 425 applications for residency positions. Of these, up to 10% express a desire to enter an academic career with an emphasis on basic research of musculoskeletal problems. In bioengineering, approximately 15 to 25 applications are made per year for pre- and post-doctoral research fellowships.

At the postdoctoral level, we anticipate that of the 10 MD-PhD combined degree candidates per medical school class, one or more would plan to pursue a research interest in biomechanics related to musculoskeletal diseases. Pre-PhD applicants for the orthopaedic engineering component come through the Mechanical and Aerospace Engineering Department and the Biomedical Engineering Department. A very large pool of applicants each year presents 10 or more highly qualified persons with a specific interest in biomechanics.

Predoctoral Candidates: Predoctoral candidates make formal application to the PhD program through either the Mechanical and Aerospace Engineering Department or through the Biomedical Engineering Department. Normally names of all candidates for graduate studies at either the MS or PhD level who indicate an interest in biomechanics are provided to Dr. Davy or Dr. Mansour for follow-up if appropriate. In addition a number of prospective students make direct contact with the Orthopaedic Engineering Lab. We provide guidance on formal application to them. For recruitment purposes, we also provide information regarding research and support opportunities.

Postdoctoral Candidates: Postdoctoral fellows in bioengineering typically come from 1) direct contact with the Orthopaedic Engineering Laboratory, or 2) through the Orthopaedics Department.

In addition to recruitment from this institution, attempts are made to recruit qualified candidates from elsewhere in the United States. This is accomplished by advertising in clinical and basic science journals such as Science, Journal of Orthopaedic Research, Journal of Immunology and the like, as well as through related national research meetings.

As in the past, targeting of the recruitment of minority candidates at all training levels is emphasized. Such emphasis is made in all advertisements, and in verbal communication with faculty within our own university and with faculty from other institutions. Recruitment guidance is sought from the Office of Minority Affairs of CWRU and of the Dean's Office at the School of Medicine.

Trainee candidate application statistics for the past 5 years are presented in Table 2 (pp 87-89).

5. Training Support

Table 3 (p 90) lists current and pending other training support including funding source, name of the program director, project period, number of trainee positions and a list of those faculty also named in this application.

C. CURRENT AND PAST RESEARCH TRAINING RECORD

The Division of Rheumatic Diseases comprises 7 full-time MD rheumatology/researchers and 5 PhD basic research faculty. Research activities of this unit (see Appendix 3) include major research commitments to studies of cartilage metabolism/pathophysiology in normal and disease states (osteoarthritis and inflammatory arthritis); studies of pathogenesis of osteoarthritis, utilizing experimental animal models (partial meniscectomy model of osteoarthritis; Psammomys obesus model of disc degeneration); studies of hormonal and enzyme interplays in experimental models of arthritis; studies of T-lymphocyte regulation in systemic lupus erythematosus; studies of molecular immunogenetics and animal models particularly as they relate to systemic lupus erythematosus; and studies of complement interactions in connective tissue disease.

Areas of targeted research interest by members of the Department of Orthopaedics (see Appendix 3), comprising 28 full-time faculty, include transplantation studies of cartilage and bone with evaluation of both vascularized and nonvascularized allografts; studies of microvascular surgical techniques and related pathophysiologic processes; studies of collagen metabolism and calcification processes of bone; development of improved hip and knee total joint prostheses based on techniques of defining basic stresses and strains that fall through these prostheses utilizing sophisticated telemetry; studies of mobility disorders including functional control of spasticity through electrical stimulation; mechanisms of spinal cord injury; studies of bioactive factors in skeletal repair; and basic studies directed toward utilization of marrow stem cells and embryonal cells in cartilage repair.

Research interests of the Department of Developmental Biology include physiology of articular cartilage, extracellular matrix biochemistry, role of bioactive factors in conversion of cartilage to bone, and lineage of osteogenic cells, topics of strong collaborative interest to rheumatology and orthopaedics.

SECTION IV
PROGRESS REPORT SUMMARY

GRANT NUMBER
2 AR 07555-03

PRINCIPAL INVESTIGATOR OR PROGRAM DIRECTOR
Roby C. Thompson, Jr.

APPLICANT ORGANIZATION
University of Minnesota

FROM
07

CLINICAL TRAINING

X MAJOR ___ MINOR

REHAB $ 84406

TITLE OF PROJECT (Repeat title shown in item 1 on first page)
Musculoskeletal/Orthopedics Sciences Training Program

(SEE INSTRUCTIONS)

1. The objectives and goals of the second year of our training grant have been to recruit qualified candidates to our program, to enroll them in our training program, and then to institute the training procedures outlined in our original proposal. We have been successful in filling our available slots of 4 M.D. and Ph.D. postdoctoral slots and 4 pre-Ph.D. slots with well qualified candidates. We are quite satisfied with the number of high quality applicants for the training positions, so we have a good choice from among the applicants to match our capabilities; we are especially pleased to see that we are attracting M.D. postdocs who are interested in spending 2 years full-time in research. During this year, we have initiated and have in operation (1) a weekly departmental research meeting, (2) a weekly laboratory research meeting, (3) a weekly osteoarthritis study group, and (4) a monthly journal club for research literature. The trainees participate in all of these, including oral presentation of their ongoing work.

2. Training Related Expenses were of special value to the training program. We used them to provide each trainee with a book fund, a research supplies fund, ads for the training program, copying costs for the trainees, and secretarial services for the training grant. Specific funds to the trainees are valauble because they encourage collecting a scholarly library and relevant computer software, and they make the training program attractive. Costs for secretarial services are especially useful so that the department does not have to bear too heavy a burden to support the training program, making it desirable to other members of the department.

3. Trainees appointed to the program during this reporting period:

Glenn Buttermann, M.D.: completed one year of general surgery residency prior to entering program; appointed 7-1-88 to 6-30-89

Gordon Walker, M.D.: completed one year of general surgery residency prior to entering program; appointed 7-1-88 to 6-30-89

Lata Sundaram, Ph.D.; Ph.D. in Biochemistry prior to entering program; appointed 7-19-88

Brian Maldonado, Ph.D.; Ph.D. in Biochemistry prior to entering program; appointed 12-16-88

Michele Chin-Purcell, M.S. in Mechanical Engineering prior to entering program; appointed 1-5-89 to 1-4-90

Steven Kirstukas, M.S. in Mechanical Engineering prior to entering program; appointed 7-1-88

Peter Mente, M.S. in Bioengineering prior to entering program; appointed 7-1-88

Alan Eberhardt, M.S. in Civil Engineering prior to entering program; appointed 12-16-88

Trainees completing their program:

32. Research Plan.

a. Abstract.

This study will investigate the strategies that are used during learning to obtain the movement invariances one observes in practiced movements. The structure of the neural control system must constrain what types of movement can be learned and how movements are learned. The study of limb kinematics during motor learning may reveal the movement parameters that are explicitly controlled by the nervous system. Quantitative changes in motor output will be measured as human subjects practice and learn simple throwing movements. The kinematics of the movement will be studied using a Watsmart System for measurement and recording of limb position over time and a Symbolics Lisp Machine, a computer work station, will be used for data analysis. To obtain some insight into the neuromuscular strategies used in motor learning, electromyographic (EMG) recordings will be obtained from the principle agonist and antagonist muscles. Motor learning will be investigated for both single-joint (elbow) and multi-joint (unrestrained arm) movements.

b. Specific Aims.

The overall objective of this research plan is to use the study of motor learning as a tool to understanding the neural control system. When the control system is asked to modify the performance of the mechanical system it may reveal the hidden processes which underlie both movement and learning. The study of adaptive change in the oculomotor and vestibulo-ocular systems has yielded invaluable information about the nature of the central nervous system control of eye movement (Keller and Zee, 1986; Miles, 1986). Similarly the study of motor learning can give us insight into the neural control of limb movement.

1) Experiments will be done to test the general hypothesis that regularities in motor performance emerge during motor learning. The invariant features of movement (for example, symmetry of the tangential velocity profile) could be present on the first trial and other aspects of the movement task could change over the practice trials. Alternatively, the invariant properties of practiced movements could change during learning. That is, the observed invariances could be learned phenomena, acquired through practice. The first outcome would imply that the neural control system is, in fact, highly constrained and that it generates only particular types of movements. The second outcome, i.e. invariant features appear at some stage of movement acquisition, would give us some insight into the control system by revealing how it adapts or changes.

The common assumption that with practice movements tend to be performed more smoothly and gracefully will be investigated. If this assumption is true, a quantitative measure of smoothness (the integral of the squared rate of change of acceleration) should decrease with the number of practice trials. In this task accuracy is determined by the release angle and the release velocity. Thus, an increase in "smoothness" during learning here may implicate invariant property of the control system, since theoretically, "smoothness" is not necessary for adequate completion of a throwing task.

2) A second hypothesis which will be addressed in these experiments is that when performing a novel task the stiffness about a given joint is increased. The combined effect of muscle mechanical properties and neural feedback gains will be measured

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30. F. Abstracts

1. Markel MD, Richardson DW, Nunamaker DM. Comminuted first phalanx fractures in horses; surgical vs. non-surgical treatments. Vet Surg 14:59, 1985.

2. Markel MD, Meagher DM, Ford TS, McCullough CL. Colopexy of the equine large colon. In Second Equine Colic Research Symposium. Symposium abstracts, pp. 43, 1985.

3. Markel MD, Madigan JE. Vertebral body osteomyelitis in 5 horses. In Proceedings of the Third Annual Medical Forum, pp. 147, 1985.

4. Markel MD, Meagher DM, Ford TS. Colopexy [illegible] Surg 15:128, 1986.

31. Not applicable

CLINICAL TRAINING

X MAJOR ___ MINOR

REHAB $ 31,750

32. Research plan.

A. Abstract

The evaluation of fracture healing, fracture union, and return of the bone to a normal state is a subjective assessment. Current methods of monitoring healing include manual examination of the fracture for stability, radiographic evidence of healing, the empirical passage of time, and the patient's evaluation of symptomatic pain. These subjective criteria may inadequately diagnose when a fracture is functionally stable, or conversely, when the healing process is delayed and progressing to non-union. A quantitative technique for evaluation of bone healing in vivo is needed to more accurately monitor the healing process. There have been many studies which attempted to measure bone mechanical properties and to quantitate bone mineral content non-invasively during different stages of experimental fracture healing. Most of these studies were unable to quantitate fracture healing, or did not correlate microradiography, histomorphometry, or the biomechanical strength of healing fractures with non-invasive measurements in experimental fracture models. In addition, the studies which have evaluated fracture healing in vivo primarily have looked at the later phases of fracture healing rather than the critical early phases, when important initial events in cell differentiation and matrix production are likely to occur. It is our aim to develop a quantitative method of evaluating both the early and late phases of fracture healing, and to correlate non-invasive measures with microradiography, histomorphometry, and the biomechanical strengths of the fracture. The proposed study will compare normal healing and delayed healing under stable external fixation induced by a small (800 μm) and a large (2 mm) osteotomy gap. We plan to investigate and attempt to validate three non-invasive methods for evaluation of fracture healing: 1) magnetic resonance imaging (MRI), 2) quantitative computed tomography (QCT), and 3) high resolution single photon absorptiometry with a prototype device. Magnetic resonance imaging is well suited for examination of soft tissues. To date, its greatest value in the musculoskeletal system is as an aid in diagnosing various bone tumors and ischemia of the femoral head. Although cortical bone is poorly imaged with MRI, other tissues such as trabecular bone, fibrous tissue, and cartilaginous tissue can be well defined. Magnetic resonance imaging may be a technique which will accurately quantify the earlier phases of fracture healing. Bone healing also will be quantitated using QCT and single photon absorptiometry. Recently, QCT has been shown to precisely measure the mineral content of trabecular and cortical bone. Single photon absorptiometry has been shown to very precisely quantitate bone mineral content. Our high resolution adaptation of the technique is designed for measurement of bone mineral in small bones, and appears to be

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suitable for the currently proposed study. These three non-invasive techniques will be used to monitor callus tissue differentiation, including the processes of endochondral and direct membranous ossification in a canine tibial osteotomy model. The fractures will be evaluated after euthanasia at different time periods using standard radiographs, biomechanical testing, histomorphometry, and microradiography. Data will be analyzed to determine if there are correlations between these three non-invasive methods and the in vitro measures of fracture healing at different stages. In this way, we hope to validate and possibly guide optimal utilization of these new techniques in the study of bone healing.

B. Specific Aims

The long-term goal of this research program is to establish non-invasive methods of evaluating fracture healing to more accurately predict which fractures are progressing to union following specific bone repair mechanisms, and which are destined to become delayed unions or non-unions. We hope to correlate tissue type and morphological structure with mineral content determined by MRI, QCT, and single photon absorptiometry. This first phase project will investigate the feasibility of MRI, QCT, and a new method of single photon absorptiometry to precisely monitor bone healing. Thus, for the proposed investigation, we will address the following hypotheses and specific aims:

1) Hypothesis: The early reparative phase of fracture healing can be non-invasively monitored and delineated using MRI.

Specific aim: Healing of canine tibial osteotomies will be evaluated with MRI to determine T_2 and T_1 relaxation times for normal and delayed healing. Different spin-echo imaging sequences will be used for quantitation, and to determine which sequence produces the best image for evaluating fracture callus.

2) Hypothesis: Bone fracture healing can be evaluated non-invasively using QCT.

Specific aim: Healing of canine tibial osteotomies will be evaluated with QCT to make a quantitative assessment of periosteal and interfragmental new bone formation and intracortical bone resorption. The method employs a contoured calibration phantom.

3) Hypothesis: Bone fracture healing and remodeling can be evaluated non-invasively using a more refined technique of single photon absorptiometry which allows sequential quantitation of bone mineral deposition at the fracture site.

Specific aim: Healing of canine tibial osteotomies will be evaluated with a high resolution single photon absorptiometry technique. This scanning technique will be used to provide the area distribution of mineral content in and around the fracture site during fracture repair and bone remodeling.

4) Hypothesis: MRI, QCT, and single photon absorptiometry are correlated with the biomechanical properties, histomorphometry, and microradiography of healing bone.

Specific aim: We will investigate this hypothesis using 36 dogs in a longitudinal study. Dogs will be divided into 6 groups with 6 dogs per group. Tibial osteotomies will be created bilaterally in the hind limbs of each dog and stabilized with small Orthofix external fixators. One tibia of each dog will be fixed in neutralization with a gap of 800 um, while the contralateral limb will be fixed with a gap of 2.0 mm; attempting to simulate normal gap and delayed healing mechanisms, respectively. Osteotomies will be evaluated radiographically every two weeks. Groups will be euthanatized

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PROJECT TITLE: HPD - Laryngeal cancer localization and treatment (human, hamsters, dogs)
SCIENCE AREA/TRAINING: RESEARCH AND CLINICAL TRAINING
MAJOR/MINOR EMPHASIS: MAJOR
PRINCIPAL INVESTIGATOR: DAVIS, ROY K
INSTITUTION: UNIVERSITY OF WISCONSIN MADISONUTION: UNIVERSITY OF UTAH
PROJECT NUMBER: 8 K07 DC00004-05
FY 1989 AWARD AMOUNT (associated with medical rehabilitation research: $59,492

ABSTRACT:

The difference in concentration of hematoporphyrin derivative between normal epithelium, dysplastic epithelium, and invasive carcinoma will be investigated in the Syrian Golden Hamster. The ability of photoactive compounds to identify and treat severe epithelial dysplasia and squamous cell carcinoma in the larynx of pound dogs and patients with advanced squamous cell carcinoma will also be investigated.

Laryngeal cancer will be induced by spraying the larynx of hamsters on ethanol as their sole liquid diet with benzopyrene. After cancer induction hematoporphyrin derivative will be given intraperitoneally. Forty-eight hours later the animals will be sacrificed and the larynx studied histologically.

Laryngeal cancer will be induced in the dogs by giving weekly injections of 20-methylcholanthrene submucosally into one true vocal cord. The progression of carcinogenesis and the extent of the induced cancer will be determined clinically using microlaryngoscopy. After successful cancer induction hematoporphyrin derivative (HPD) will be given intravenously. Areas of fluorescence will be mapped and correlated to the clinical stage. Biopsies of fluorescent and non-fluorescent areas of the vocal cord with induced cancer will be compared. The endolarynx will then be treated using the argon dye laser. Six weeks later the cancer will be restaged and biopsied.

Patients with advanced squamous cell carcinoma of the head and neck who are not candidates for standard therapy will be given HPD as part of an already approved phase I, phase II study. The ability of photoirradiation therapy with HPD to treat the primary lesion will be studied. In addition, the ability of HPD to localize and treat areas of field cancerization beyond the primary lesion will be investigated. Use of HPD may significantly enhance the detection of dysplasia and early cancer and provide a selective, repeatable therapeutic method.

PROJECT TITLE: Pathophysiology of speech/swallowing disorders in ALS (human)
SCIENCE AREA/TRAINING: RESEARCH AND CLINICAL TRAINING
MAJOR/MINOR EMPHASIS: MAJOR
PRINCIPAL INVESTIGATOR: SUFIT, ROBERT L
INSTITUTION: UNIVERSITY OF CALIFORNIA LOS ANGELESUTION: UNIVERSITY OF WISCONSIN MADISON
PROJECT NUMBER: 8 K08 DC00018-04
FY 1989 AWARD AMOUNT (associated with medical rehabilitation research: $75,039

ABSTRACT:

The objective of this CIDA research is to specify the relations between the orofacial muscle deinnervation associated with amyotrophic lateral sclerosis (ALS) and the consequent functional disabilities that occur in speech and swallowing.

While the speech and swallowing symptoms associated with ALS have been described, almost no studies have provided data to address extant hypotheses concerning: (1) the relative severity of the ALS degeneration process in the different cranial motor nerves, or (2) the critical relations among the electromyographic, histochemical strength, speech, and swallowing aberrations that are associated with that motoneuron degeneration.

Using five independent measures, data will be obtained longitudinally on a carefully selected population of 30 ALS patients and cross sectionally on a normal control group.

The first data set will highlight speech motor functions, including analyses of the speech acoutstic signal, judgements of dysarthric severity, and measures of lip, jaw and tongue movements. Secondly, videofluoroscopic analyses will be conducted on swallowing functions. The third data set will be obtained via instrumental measurement of weakness in the lip, jaw, tongue, and wrist flexor muscle groups, while the fourth set of measures will include quantitative EMG indices of single motor unit changes typically associated with ALS in several critical muscles of the tongue, jaw, lips, and forearm. Finally, as postmortem muscle tissue becomes available from the ALS subjects, a fifth set of data will include the morphology and histochemistry of the above mentioned muscles.

These data will be analyzed to reveal critical causal relations between the orofacial neuromuscular pathophysiology associated with ALS and consequent problems in speech and swallowing.

PROJECT TITLE: Laser phototherapy for the treatment of malignancies (human, pig)
SCIENCE AREA/TRAINING: RESEARCH AND CLINICAL TRAINING
MAJOR/MINOR EMPHASIS: MAJOR
PRINCIPAL INVESTIGATOR: CASTRO, DAN J
INSTITUTION: GALLAUDET UNIVERSITYUTION: UNIVERSITY OF CALIFORNIA LOS ANGELES
PROJECT NUMBER: 8 K08 DC00031-02
FY 1989 AWARD AMOUNT (associated with medical rehabilitation research: $76,896

ABSTRACT:

Photodynamic therapy with lasers may become an attractive adjunctive modality for early diagnosis and treatment of superficial malignancies when fluorochromes with high tumor specificity and low toxicity are developed.

The specific aims of this study are to:

1. Develop a noninvasive, simple, accurate, and reproducible quantitiative method of dosimetry of laser induced damage in tissues. The beam scan technique will be developed to measure spatial profiles of laser beams. An infrared camera will allow measurement of thermal profiles in the porcine skin model after exposure to increasing levels of laser energies. Volume of damage will be quantitated by serial histological sections. Damage range constant, absorption coefficients and thresholds for lesions for the CO2, Argon and Nd:YAG lasers will be predicted. The "LAD" (laser absorptive dose) parallel to the RAD in radiology will be determined.

2. Define the basic intracellular events in laser "killing" of Rhodamine-123 sensitized human squamous carcinoma and melanoma cells in-vitro. Mitochondrial function, membrane potential and morphology will be assessed respectively by measuring oxygen consumption, 86Rb, 3H-thymidine assays and electron microscopy. ATP levels after laser and Rhodamine-123 phototherapy will be quantitated by luciferin-luciferase assays allowing measurement of mitochondrial oxidative phosphorilation.

3. Establish a randomized clinical protocol which will allow us to test the potentials of this new fluorochrome for the treatment of superficial malignancies of the head and neck with the Argon laser. Patients with recurrent Stage IV tumors (squamous cell carcinoma, melanoma) will be injected with a nontoxic, sensitizing dose of Rhodamine-123, then subjected to low energy Argon laser therapy. Optimal tumor response will be assessed according to the histological type, tumor size, dosages of Rhodamine-123, various laser energies and frequency of

CONTINUED ON NEXT PAGE

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PROJECT NUMBER: 8 K08 DC00031-02 (Continued)

treatment. Potential local and systemic toxicity of Rhodamine-123 will be evaluated.

Our study promises to provide relevant information toward the elucidation of the mechanism of action of this promising new photochemosensitizing agent, and will define the potentials for treatment of human head and neck tumors. Furthermore, the basic unit of dosimetry that will be developed with the lasers ("LAD") will allow standardization of scientific clinical and biomedical research.

PROJECT TITLE: Adaptive capabilities of postural stabilizing reflexes (human)
SCIENCE AREA/TRAINING: RESEARCH AND CLINICAL TRAINING
MAJOR/MINOR EMPHASIS: MAJOR
PRINCIPAL INVESTIGATOR: HERDMAN, SUSAN J
INSTITUTION: BOSTON UNIVERSITYUTION: JOHNS HOPKINS UNIVERSITY
PROJECT NUMBER: 8 K08 DC00032-02
FY 1989 AWARD AMOUNT (associated with medical rehabilitation research: $52,814

ABSTRACT:

Disorders of balance, especially when they result in falls, are an important and common clinical problem. The cause of disequilibrium in many instances is dysfunction of the vestibulospinal reflexes but most clinical vestibular research has focused on the vestibulo-ocular reflex (VOR). Although much is known about the adaptive strategies used by labyrinthine-deficient humans to stabilize gaze, almost nothing is known about the adaptive strategies to stabilize posture. Accordingly, the long-term objective of our research is to understand better the adaptive capabilities of postural stabilizing reflexes (PSR) with the ultimate goal to improve the physical therapy treatment of patients with balance disorders. By studying both normal subjects and patients without labyrinthine function, we will develop testing paradigms and analysis techniques for PSR adaptation that are comparable to those that have been successfully used to study VOR adaptation. PSR adaptation will be studied by measuring 1) The amplitude of sway induced by a sudden perturbation of the support surface and 2) The amplitude of sway induced in response to a moving visual stimulus. These two approaches are of particular interest because they simulate conditions in which patients with labyrinthine deficits have complaints of imbalance. Our main approach will be to quantify fore-aft sway under conditions of artificial feedback to isolate the various sensory components that contribute to the postural stabilizing reflexes. To induce adaptation, subjects will wear reversing (dove) prisms or magnifying (X2) spectacles, both of which change the apparent motion of the environment during head rotation. We will compare adaptation of the VOR with that of PSR. The results of the test in normal subjects will be compared with the results from subjects with bilateral labyrinthine deficiencies. The results of this project will be applied to the design and the assessment of physical therapy programs for patients with balance disorders.

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PROJECT TITLE: Communication device effect--conversational performance (human)
SCIENCE AREA/TRAINING: RESEARCH AND CLINICAL TRAINING
MAJOR/MINOR EMPHASIS: MAJOR
PRINCIPAL INVESTIGATOR: HIGGINBOTHAM, D JEFFERY
INSTITUTION: BOSTON UNIVERSITYUTION: STATE UNIVERSITY OF NEW YORK AT BUFFALO
PROJECT NUMBER: 1 K08 DC00034-01
FY 1989 AWARD AMOUNT (associated with medical rehabilitation research: $59,496

ABSTRACT:

This project attempts to address the gap between the technological development of Augmentative Communication Devices (ACDs) and our understanding of the cognitive and linguistic processing needed for their use. Towards this goal, I propose to study the influence of ACDs on the way users and their partners communicate. The research is aimed at determining the effects on communication of the type of device used as well as the permanancy, redundancy, and temporal/spatial characteristics of the message created by the device. These device related variables will be studied for their influence on (1) the user's ability to refer to subjects and events; (2) the receiver's ability to comprehend the message; (3) the user's and receiver's ability to manage the interaction, and (4) the judgments receivers and observers make about the competence of the ACD users. Based on the data obtained from these studies, a model of augmentative communication will be developed and evaluated for how well it predicts conversational performance in experimental and naturalistic contexts. Years 1-3 will involve the study of dyadic communication in a controlled experimental context. Nonhandicapped adults will serve as subjects to reduce the subject variability found among handicapped users. Research during years 3 and 4 will extend the experimental work to include single-subject studies of handicapped ACD users in both experimental and naturalistic settings. Finally, a prototype ACD will be developed using the findings of the studies. The overall aim is to develop a set of social communication specifications for the production of a new generation of socially appropriate communication technologies.

PROJECT TITLE: Head and neck carcinoma cell kinetics (human, mice)
SCIENCE AREA/TRAINING: RESEARCH AND CLINICAL TRAINING
MAJOR/MINOR EMPHASIS: MAJOR
PRINCIPAL INVESTIGATOR: COLTRERA, MARC D
INSTITUTION: BOSTON UNIVERSITYUTION: UNIVERSITY OF WASHINGTON
PROJECT NUMBER: 1 K08 DC00036-01
FY 1989 AWARD AMOUNT (associated with medical rehabilitation research: $62,640

ABSTRACT:

The overall goals of the project are to: a) study tumor cell kinetics in head and neck carcinomas using newly developed monoclonal antibodies which identify proliferating cells in tissue sections and; b)develop a new classification system of head and neck tumors which integrates the slide-based cell kinetic information with traditional histologic and morphologic criteria. We hypothesize that this integrative tumor classification system will contain more accurate prognostic information than the present TNM/Stage I-IV system. A panel of currently available monoclonal antibodies which are specific for proliferating cells will be evaluated in frozen and fixed, Paraffin-embedded new and archival head and neck tumor specimens in order to systematically determine the fixation and immunostaining requirements of these antibodies. As none of the currently available proliferation-specific monoclonal antibodies can be used in formaldehyde-fixed, paraffin-embedded tissues, new proliferation-specific monoclonal antibodies capable of reacting with S-phase cells in archival formalin-fixed, paraffin-embedded tissue will be developed. Using immunocytochemical techniques with these antibodies and correlative flow cytometry, intratumor variations in cell kinetics in head and neck carcinomas will be studies. Prospective and retrospective studies of head and neck carcinomas and paraffin-embedded tumor specimens will be undertaken with the aim of correlating the cell kinetic data derived from immunocytochemical analysis of these tumors with such clinical endpoints as disease-free intervals, recurrences, metastases, survival.

The applicant is presently a head and neck surgery fellow in the Dept. of Otolaryngology at the University of Washington. After completion of this two year clinical/research fellowship in July of 1988, the applicant will be joining the department as an assistant professor, as he intends to pursue an academic career with a firm commitment to both bench research and clinical surgical oncology. A CIDA would make it possible for the applicant to complete the training and background studies necessary for independent investigation while maintaining

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PROJECT NUMBER: 1 K08 DC00035-01 (Continued)
clinical skills which are central to his future plans. Furthermore, it would afford him the opportunity of working within the Pathology Dept. of the Univ. of Washington in which there are many other researchers working at the interface of clinical medicine and tumor biology.

Table 16

NIH Awards by Funding Mechanism, Fiscal Years 1980–1989

(Dollars in Millions)

Funding mechanism	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
					AMOUNT					
Total	**$2,788.6**	**$2,883.7**	**$2,930.1**	**$3,246.4**	**$3,657.6**	**$4,248.1**	**$4,426.6**	**$5,194.2**	**$5,544.8**	**$6,009.0***
R&D grants	2,161.1	2,331.4	2,407.7	2,702.3	3,087.0	3,591.3	3,739.1	4,401.2	4,727.3	5,054.7
R&D contracts	432.4	366.9	358.7	370.3	394.7	417.7	462.6	544.4	565.1	657.2
Research training	182.8	181.7	156.3	171.1	173.2	224.0	217.1	238.8	245.7	261.0
Individual awards	38.9	35.5	31.2	34.4	34.4	46.4	42.8	46.6	45.0	45.9
Institutional awards	143.9	146.2	125.1	136.7	138.8	177.5	174.4	192.1	200.6	215.1
Construction grants	10.8	2.0	6.2	1.5	1.0	12.1	5.0	6.9	–	–
Other	1.6	1.6	1.1	1.2	1.7	3.0	2.8	3.0	6.7	36.1*
					NUMBER					
R&D grants	20,061	20,418	19,893	20,819	21,535	22,958	23,445	25,026	25,754	26,022
R&D contracts	1,622	1,340	1,180	1,110	1,150	1,335	1,298	1,257	1,252	1,311
Research training	3,488	3,121	3,020	3,096	3,119	3,341	3,157	3,404	3,348	3,277
Individual awards	1,973	1,752	1,726	1,756	1,759	1,985	1,823	2,032	1,944	1,845
Institutional awards	1,515	1,369	1,294	1,340	1,360	1,356	1,334	1,372	1,404	1,432
Construction grants	10	6	18	3	3	33	29	35	–	–

**Includes grants for repair, renovation, and modernization of existing research facilities ($28.9 million).*

Table 17

NIH Awards by NIH Component and Funding Mechanism, Fiscal Year 1989

(Dollars in Thousands)

NIH component	Total amount	Research and development										Research training				Other awards
		Total		Project grants		Center grants		Other grants		Contracts		Individual awards		Institutional awards		
		Number	Amount	Number	Amount	Number	Amount	Number	Amount	Number	Amount	Number	Amount	Number	Amount	
Total	**$6,008,998**	**26,022**	**$5,054,738**	**21,199**	**$4,058,547**	**631**	**$607,083**	**4,192**	**$389,108**	**1,311**	**$657,189**	**1,845**	**$45,868**	**1,432**	**$215,090**	**$36,113**
NIA	177,108	789	162,039	647	132,211	21	21,874	121	7,954	15	6,892	32	831	64	7,347	–
NIAID	622,096	2,386	494,152	2,188	467,423	26	18,010	172	8,719	156	113,631	94	2,546	78	11,767	–
NIAMS	143,203	759	134,328	658	108,130	26	21,401	75	4,796	9	2,553	29	753	58	5,569	–
NCI	1,225,112	3,987	929,071	3,273	735,281	61	101,127	653	92,662	421	263,533	160	3,878	171	28,630	–
NICHD	348,140	1,799	303,269	1,569	259,846	50	33,676	180	9,746	89	31,106	86	2,288	110	11,477	–
NIDCD	88,277	456	84,717	410	74,686	9	7,826	37	2,205	4	1,070	16	415	24	2,075	–
NIDR	95,706	560	87,151	396	61,747	19	14,478	145	10,926	16	3,367	35	951	55	4,237	–
NIDDK	472,888	2,381	439,111	2,109	391,380	42	34,185	230	13,547	41	12,193	130	3,807	165	17,776	–
NIEHS	172,059	450	104,110	379	76,394	16	16,198	55	11,518	151	59,079	35	878	40	7,992	–
NEI	199,538	1,328	188,541	1,178	170,052	32	7,015	118	11,475	34	4,987	78	1,905	34	4,104	–
NIGMS	664,518	3,601	582,345	3,431	568,532	10	6,519	160	7,294	2	6,581	486	11,368	302	64,224	–
NHLBI	923,469	3,517	782,297	2,912	659,317	63	87,870	542	35,109	223	101,710	188	5,395	220	34,067	–
NINDS	392,380	2,211	368,012	1,914	331,447	30	22,397	267	14,168	39	11,389	178	4,243	71	8,737	–
DRR	398,528	1,581	363,440	–	–	222	213,204	1,359	150,236	4	3,670	3	91	16	2,453	28,875
FIC	8,827	–	–	–	–	–	–	–	–	1	23	141	4,413	4	692	3,700
NCNR	28,218	159	24,804	135	22,101	4	1,303	20	1,401	–	–	151	2,007	12	1,406	–
NLM	36,443	58	7,350	–	–	–	–	58	7,350	85	22,919	3	99	8	2,537	3,538
CC, DRS, and OD	12,488	–	–	–	–	–	–	–	–	21	12,488	–	–	–	–	–

Table 38

Major NIH Career Development Awards by Recipient's Type of Doctorate,* Fiscal Years 1980–1989

(Dollars in Thousands)

Kind of award and code	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
AMOUNTS OF INDIVIDUAL AWARDS										
Total	**$47,489**	**$47,034**	**$47,039**	**$47,130**	**$50,166**	**$70,537**	**$72,700**	**$79,851**	**$83,400**	**$81,482**
Modified research career development (K04)	**33,681**	**30,760**	**30,004**	**26,797**	**24,762**	**29,838**	**27,477**	**24,846**	**23,925**	**20,744**
M.D. or equivalent	8,589	7,548	6,989	5,781	5,290	6,651	6,060	5,520	5,583	5,065
Ph.D. or equivalent	24,707	22,878	22,633	20,012	18,790	22,024	20,499	18,473	17,815	15,364
Other	384	334	383	1,004	682	1,163	918	853	527	316
Academic/Teacher (K07)	**7,739**	**9,205**	**9,746**	**11,755**	**11,467**	**13,767**	**11,169**	**12,198**	**10,051**	**8,590**
M.D. or equivalent	6,354	7,644	7,857	9,610	9,110	11,344	9,043	9,942	7,796	7,039
Ph.D. or equivalent	1,319	1,452	1,773	1,922	2,154	1,987	1,676	1,861	2,024	1,315
Other	65	109	116	223	204	436	451	395	231	236
Clinical investigator (K08)	**6,069**	**7,069**	**7,288**	**8,579**	**11,896**	**20,603**	**24,268**	**27,764**	**30,332**	**31,059**
M.D. or equivalent	5,837	6,786	6,903	7,821	10,579	18,162	20,971	24,740	27,407	28,636
Ph.D. or equivalent	135	188	385	525	590	1,135	1,694	1,802	1,790	1,648
Other	98	95	–	233	727	1,305	1,602	1,222	1,135	775
Physician scientist (K11)	–	–	–	–	**2,041**	**6,129**	**9,226**	**13,901**	**17,671**	**19,229**
M.D. or equivalent	–	–	–	–	1,988	5,919	8,815	13,361	16,613	18,054
Ph.D. or equivalent	–	–	–	–	53	135	68	174	450	759
Other	–	–	–	–	–	74	343	367	607	416
Dentist scientist (K15)	–	–	–	–	–	**201**	**560**	**1,142**	**1,422**	**1,860**
M.D. or equivalent	–	–	–	–	–	136	505	1,083	1,305	1,676
Ph.D. or equivalent	–	–	–	–	–	–	–	–	50	53
Other	–	–	–	–	–	65	55	59	67	131
AMOUNTS OF PROGRAM AWARDS										
Total	–	–	–	–	**372**	**2,430**	**3,865**	**6,032**	**7,775**	**8,649**
Physician scientist (K12)	–	–	–	–	**372**	**1,472**	**2,397**	**3,429**	**4,079**	**4,307**
Dentist scientist (K16)	–	–	–	–	–	**958**	**1,468**	**2,604**	**3,696**	**4,342**

**Awards to recipients holding both M.D. and Ph.D. or equivalent are under M.D.*

(Continued)

Table 38 (Cont.)

Major NIH Career Development Awards by Recipient's Type of Doctorate,* Fiscal Years 1980–1989

(Dollars in Thousands)

Kind of award and code	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
NUMBERS OF INDIVIDUAL AWARDS										
Total	**1,246**	**1,167**	**1,144**	**1,106**	**1,133**	**1,249**	**1,237**	**1,308**	**1,347**	**1,278**
Modified research career development (K04)	**934**	**821**	**787**	**700**	**633**	**587**	**539**	**486**	**459**	**396**
M.D. or equivalent	226	198	181	153	137	128	119	107	106	97
Ph.D. or equivalent	697	614	596	520	479	437	402	362	343	293
Other	11	9	10	27	17	22	18	17	10	6
Academic/Teacher (K07)	**175**	**191**	**197**	**227**	**224**	**219**	**168**	**168**	**134**	**102**
M.D. or equivalent	138	155	157	183	178	180	135	134	99	81
Ph.D. or equivalent	35	34	37	39	43	34	28	30	33	19
Other	2	2	3	5	3	5	5	4	2	2
Clinical investigator (K08)	**137**	**155**	**160**	**179**	**239**	**344**	**382**	**431**	**470**	**471**
M.D. or equivalent	131	148	151	163	212	295	330	384	425	433
Ph.D. or equivalent	4	5	9	11	12	18	26	27	28	26
Other	2	2	–	5	15	31	26	20	17	12
Physician scientist (K11)	–	–	–	–	**37**	**96**	**139**	**205**	**262**	**280**
M.D. or equivalent	–	–	–	–	36	93	133	197	246	262
Ph.D. or equivalent	–	–	–		1	2	1	3	7	12
Other	–		–	–	–	1	5	5	9	6
Dentist scientist (K15)	–	–	–	–	–	**3**	**9**	**18**	**22**	**29**
M.D. or equivalent	–		–	–	–	2	8	17	20	26
Ph.D. or equivalent	–	–		–	–	–	–	–	1	1
Other	–		–	–	–	1	1	1	1	2
NUMBERS OF PROGRAM AWARDS										
Total	–	–	–	–	**3**	**17**	**18**	**21**	**21**	**21**
Physician scientist (K12)	–	–	–	–	**3**	**9**	**9**	**12**	**12**	**12**
Dentist scientist (K16)		–	–	–	–	**8**	**9**	**9**	**9**	**9**

See footnote on first page of table.

Table 39

Number of Appointments in NIH Research Training Programs by Academic Level and Type,* Fiscal Years 1980–1989

Academic level	1980	1981	1982	1983	1984	1985	1986	1987 (est.)	1988 (est.)	1989 (est.)
Total of A or B	**12,091**	**12,182**	**11,930**	**12,132**	**12,005**	**12,098**	**11,627**	**11,920**	**11,532**	**11,585**
A. ACADEMIC LEVEL										
Predoctoral	**6,343**	**6,682**	**6,534**	**6,648**	**6,590**	**6,358**	**6,084**	**6,309**	**6,324**	**6,216**
Individual	17	20	23	27	43	42	112	195	193	205
Predoctoral NRSA (F31)	–	4	11	23	39	39	105	186	183	198
MARC NRSA faculty fellowships (F34)	17	16	12	4	4	3	7	9	10	7
Institutional	6,326	6,662	6,511	6,621	6,547	6,316	5,972	6,114	6,131	6,011
NRSA (T32 excluding MSTP)	4,687	4,833	4,281	4,282	4,125	3,981	3,777	3,848	3,846	3,965
MSTP	672	709	690	678	692	713	701	768	765	740
Continuing education training (T15)	37	36	18	9	1	1	–	7	14	20
MARC undergraduate NRSA (T34)	–	10	369	374	404	434	451	434	475	187
NRSA short-term research training (T35)	930	1,074	1,153	1,278	1,325	1,187	1,043	1,057	1,031	1,099
Postdoctoral	**5,748**	**5,500**	**5,396**	**5,484**	**5,415**	**5,740**	**5,543**	**5,611**	**5,208**	**5,369**
M.D.	2,092	2,051	2,094	2,224	2,297	2,435	2,439	2,515	2,425	2,582
Individual	283	259	272	326	367	370	349	373	376	346
Postdoctoral NRSA (F32)	275	250	262	313	358	347	311	325	334	319
NRSA to senior fellows (F33)	6	7	7	11	7	6	7	11	6	2
MARC NRSA faculty fellowships (F34)	2	2	3	2	2	2	1	–	–	–
Intramural NRSA postdoctoral (F35)	–	–	–	–	–	15	30	37	36	22
Medical informatics fellowships (F37)	–	–	–	–	–	–	–	–	–	3
Institutional	1,809	1,792	1,822	1,898	1,930	2,065	2,090	2,142	2,049	2,236
Continuing education training (T15)	45	55	57	43	40	22	25	39	44	n.a.
NRSA (T32)	1,755	1,727	1,751	1,841	1,887	2,038	2,053	2,083	1,984	n.a.
NRSA short-term research training (T35)	9	10	14	14	3	5	12	20	21	n.a.
Ph.D.	3,656	3,449	3,302	3,260	3,118	3,305	3,104	3,096	2,783	2,787
Individual	1,469	1,296	1,244	1,253	1,197	1,414	1,203	1,308	1,226	1,153
Postdoctoral NRSA (F32)	1,429	1,250	1,200	1,207	1,154	1,364	1,162	1,273	1,188	1,105
NRSA to senior fellows (F33)	23	34	28	27	25	24	21	21	24	34
MARC NRSA faculty fellowships (F34)	17	10	16	19	18	20	15	9	5	7
Intramural NRSA postdoctoral (F35)	–	–	–	–	–	5	4	5	9	7
MARC visiting scientists (F36)	–	2	–	–	–	1	1	–	–	–
Institutional	2,187	2,153	2,058	2,007	1,921	1,891	1,901	1,788	1,557	1,634
Continuing education training (T15)	17	11	16	11	5	5	3	–	3	n.a.
NRSA (T32)	2,118	2,067	1,966	1,930	1,858	1,831	1,834	1,749	1,541	n.a.
NRSA short-term research training (T35)	52	75	76	66	58	55	64	39	13	n.a.

*Revised. Based on year of funding. Excludes FIC. "M.D." includes equivalent professional doctorates. "Ph.D." includes equivalent academic doctorates. "M.D. and Ph.D." or equivalent included under "M.D."

NOTE: Number of appointments differs from corresponding number of FTTP (see Table 40) because a trainee in a part-time position is counted as a full unit under appointments but as a fraction of a unit under FTTP. In addition, these data are not strictly comparable with FTTP counts because of somewhat different methods used by the two data sources.

Source: Division of Research Grants, NIH

(Continued)

Table 39 (Cont.)

Number of Appointments in NIH Research Training Programs by Academic Level and Type,* Fiscal Years 1980–1989

Type of appointment	1980	1981	1982	1983	1984	1985	1986	1987 (est.)	1988 (est.)	1989 (est.)
Total of A or B	**12,091**	**12,182**	**11,930**	**12,132**	**12,005**	**12,098**	**11,627**	**11,920**	**11,532**	**11,585**
					B. TYPE OF APPOINTMENT					
Individual	**1,769**	**1,575**	**1,539**	**1,606**	**1,607**	**1,826**	**1,664**	**1,876**	**1,795**	**1,704**
Predoctoral (F31, F34)	17	20	23	27	43	42	112	195	193	205
Postdoctoral	1,752	1,555	1,516	1,579	1,564	1,784	1,552	1,681	1,602	1,499
F32	1,704	1,500	1,462	1,520	1,512	1,711	1,473	1,598	1,522	1,424
F33, F34, F35, F36, F37	48	55	54	59	52	73	79	83	80	75
Institutional	**10,322**	**10,607**	**10,391**	**10,526**	**10,398**	**10,272**	**9,963**	**10,044**	**9,737**	**9,881**
Predoctoral	6,326	6,662	6,511	6,621	6,547	6,316	5,972	6,114	6,131	6,011
T32	5,359	5,542	4,971	4,960	4,817	4,694	4,478	4,616	4,611	4,705
T35	930	1,074	1,153	1,278	1,325	1,187	1,043	1,057	1,031	1,099
T15, T34	37	46	387	383	405	435	451	441	489	207
Postdoctoral	3,996	3,945	3,880	3,905	3,851	3,956	3,991	3,930	3,606	3,870
T32	3,873	3,794	3,717	3,771	3,745	3,869	3,887	3,832	3,525	3,809
T15, T35	123	151	163	134	106	87	104	98	81	61

See footnotes on first page of table.

Figure 39.1

NIH Postdoctoral Training Appointments, Fiscal Year 1989

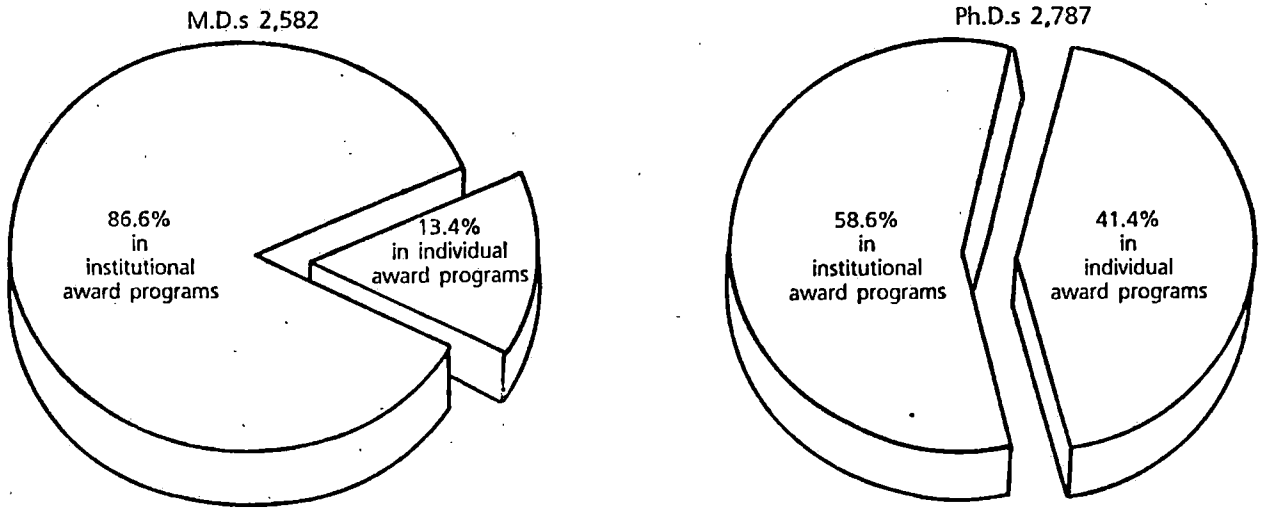


Figure 39.2

Number of Appointments in NIH Research Training Programs by Academic Level, Fiscal Years 1980–1989

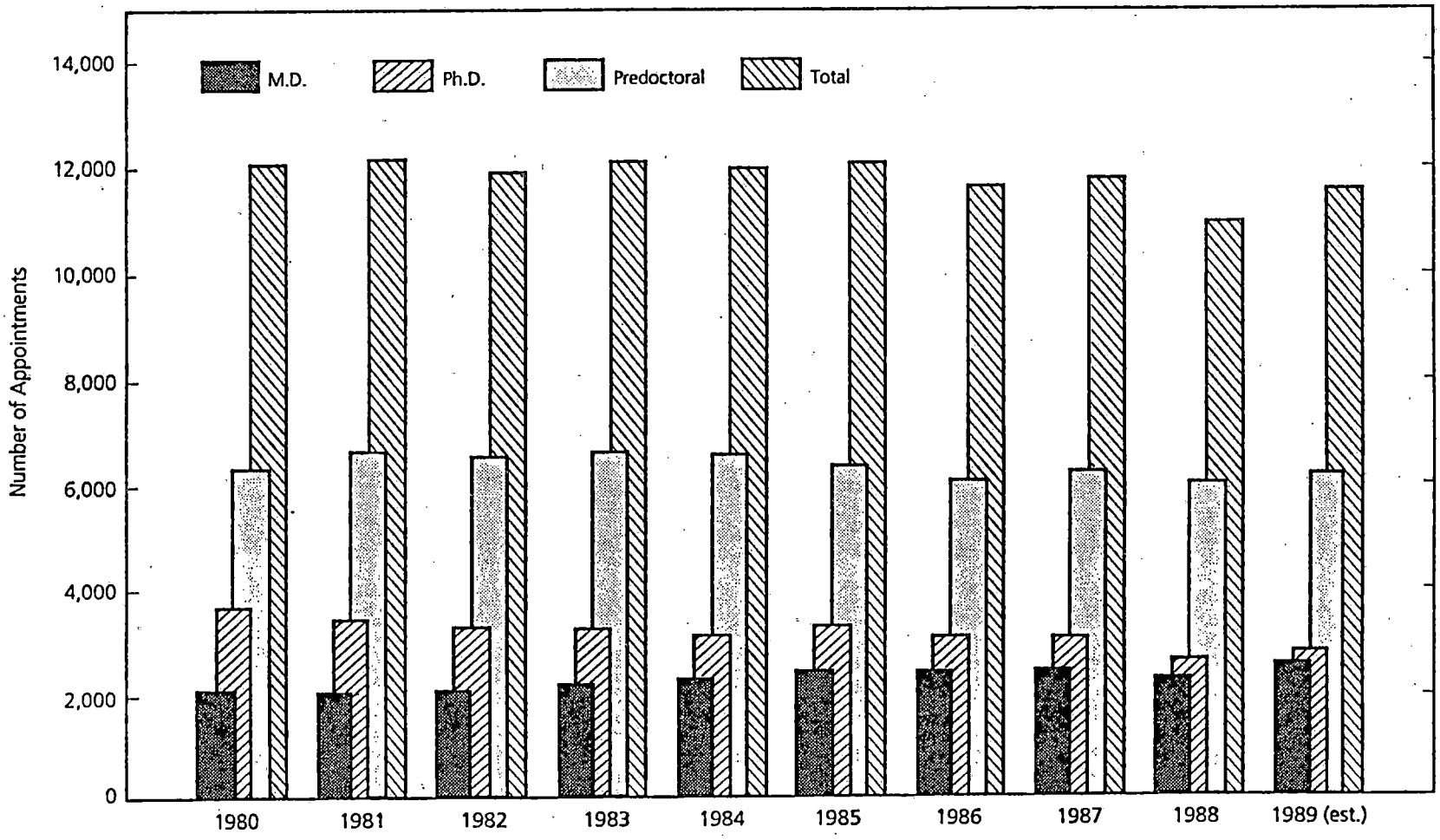


Table 40

Number of NIH Full-Time-Equivalent Training Positions (FTTP)* by Academic Level, NIH Component, and Type, Fiscal Years 1980–1989

Fiscal year and academic level	Total NIH			NIA			NIAID			NIADDK			NIAMS			NCI		
	Total	Indiv.	Inst'l	Total	Indiv.	Inst'l	Total	Indiv.	Inst'l	Total	Indiv.	Inst'l	Total	Indiv.	Inst'l	Total	Indiv.	Inst'l
1980	10,664	1,786	8,878	167	26	141	522	113	409	937	267	670	–	–	–	1,530	222	1,308
Predoctoral	5,095	16	5,079	73	–	73	137	–	137	–	–	–	–	–	–	538	–	538
Postdoctoral	5,569	1,770	3,799	94	26	68	385	113	272	937	267	670	–	–	–	992	222	770
1981	10,695	1,574	9,121	163	31	132	483	106	377	887	180	707	–	–	–	1,531	206	1,325
Predoctoral	5,353	21	5,332	71	–	71	149	–	149	–	–	–	–	–	–	555	–	555
Postdoctoral	5,342	1,553	3,789	92	31	61	334	106	228	887	180	707	–	–	–	976	206	770
1982	10,406	1,539	8,867	160	21	139	462	92	370	965	198	767	–	–	–	1,498	161	1,337
Predoctoral	5,081	26	5,055	74	–	74	150	–	150	–	–	–	–	–	–	568	–	568
Postdoctoral	5,325	1,513	3,812	86	21	65	312	92	220	965	198	767	–	–	–	930	161	769
1983	10,570	1,607	8,963	170	15	155	479	102	377	916	211	705	–	–	–	1,483	161	1,322
Predoctoral	5,254	34	5,220	83	–	83	146	–	146	52	–	52	–	–	–	572	–	572
Postdoctoral	5,316	1,573	3,743	87	15	72	333	102	231	864	211	653	–	–	–	911	161	750
1984	10,514	1,606	8,908	161	18	143	494	90	404	977	199	778	–	–	–	1,465	178	1,287
Predoctoral	5,149	51	5,098	71	–	71	147	–	147	70	–	70	–	–	–	566	–	566
Postdoctoral	5,365	1,555	3,810	90	18	72	347	90	257	907	199	708	–	–	–	899	178	721
1985	10,624	1,831	8,793	227	24	203	518	75	443	1,046	203	843	–	–	–	1,464	241	1,223
Predoctoral	4,963	52	4,911	93	–	93	163	–	163	107	–	107	–	–	–	542	2	540
Postdoctoral	5,661	1,779	3,882	134	24	110	355	75	280	939	203	736	–	–	–	922	239	683
1986	10,382	1,753	8,629	263	31	232	487	67	420	987	195	792	–	–	–	1,394	174	1,220
Predoctoral	5,011	204	4,807	98	–	98	156	–	156	99	–	99	–	–	–	521	4	517
Postdoctoral	5,371	1,549	3,822	165	31	134	331	67	264	888	195	693	–	–	–	873	170	703
1987	11,181	1,877	9,304	313	36	277	491	71	420	–	–	–	242	40	202	1,475	175	1,300
Predoctoral	5,438	196	5,242	137	–	137	155	–	155	–	–	–	15	–	15	577	9	568
Postdoctoral	5,743	1,681	4,062	176	36	140	336	71	265	–	–	–	227	40	187	898	166	732
1988	11,329	1,795	9,534	344	36	308	561	100	461	–	–	–	238	35	203	1,456	141	1,315
Predoctoral	5,560	191	5,369	139	–	139	173	–	173	–	–	–	17	–	17	568	8	560
Postdoctoral	5,769	1,604	4,165	205	36	169	388	100	288	–	–	–	221	35	186	888	133	755
1989	11,225	1,696	9,529	387	32	355	579	94	485	–	–	–	219	29	190	1,428	162	1,266
Predoctoral	5,726	205	5,521	167	–	167	189	0	189	–	–	–	14	0	14	548	8	540
Postdoctoral	5,499	1,491	4,008	220	32	188	390	94	296	–	–	–	205	29	176	880	154	726

*Based on year of funding. Excludes FIC F05, F06, and F15 fellowships and NLM training programs.

Source: Division of Financial Management

(Continued)

Table 40 (Cont.)

Number of NIH Full-Time-Equivalent Training Positions (FTTP)* by Academic Level, NIH Component, and Type, Fiscal Years 1980–1989

Fiscal year and academic level	NICHD			NIDCD			NIDR			NIDDK			NIEHS			NEI		
	Total	Indiv.	Inst'l	Total	Indiv.	Inst'l	Total	Indiv.	Inst'l	Total	Indiv.	Inst'l	Total	Indiv.	Inst'l	Total	Indiv.	Inst'l
198[illegible]	739	135	604	–	–	–	231	64	167	–	–	–	445	32	413	278	98	180
Predoctoral	366	–	366	–	–	–	85	–	85	–	–	–	254	–	254	40	–	40
Postdoctoral	373	135	238	–	–	–	146	64	82	–	–	–	191	32	159	238	98	140
198[illegible]	571	65	506	–	–	–	283	70	213	–	–	–	462	32	430	231	74	157
Predoctoral	340	–	340	–	–	–	112	–	112	–	–	–	268	–	268	35	–	35
Postdoctoral	231	65	166	–	–	–	171	70	101	–	–	–	194	32	162	196	74	122
198[illegible]	626	114	512	–	–	–	203	50	153	–	–	–	446	33	413	223	72	151
Predoctoral	310	–	310	–	–	–	27	–	27	–	–	–	256	–	256	42	–	42
Postdoctoral	316	114	202	–	–	–	176	50	126	–	–	–	190	33	157	181	72	109
198[illegible]	671	95	576	–	–	–	221	44	177	–	–	–	459	30	429	219	79	140
Predoctoral	344	–	344	–	–	–	51	–	51	–	–	–	262	–	262	38	–	38
Postdoctoral	327	95	232	–	–	–	170	44	126	–	–	–	197	30	167	181	79	102
198[illegible]	656	113	543	–	–	–	221	41	180	–	–	–	448	28	420	222	85	137
Predoctoral	326	–	326	–	–	–	57	–	57	–	–	–	255	–	255	37	–	37
Postdoctoral	330	113	217	–	–	–	164	41	123	–	–	–	193	28	165	185	85	100
198[illegible]	702	127	575	–	–	–	197	37	160	–	–	–	483	44	439	220	111	109
Predoctoral	333	–	333	–	–	–	44	–	44	–	–	–	262	–	262	25	–	25
Postdoctoral	369	127	242	–	–	–	153	37	116	–	–	–	221	44	177	195	111	84
198[illegible]	728	115	613	–	–	–	192	45	147	–	–	–	446	43	403	232	118	114
Predoctoral	344	–	344	–	–	–	44	–	44	–	–	–	243	–	243	33	–	33
Postdoctoral	384	115	269	–	–	–	148	45	103	–	–	–	203	43	160	199	118	81
198[illegible]	736	99	637	–	–	–	225	55	170	915	164	751	462	41	421	229	101	128
Predoctoral	360	–	360	–	–	–	61	–	61	133	–	133	268	–	268	37	–	37
Postdoctoral	376	99	277	–	–	–	164	55	109	782	164	618	194	41	153	192	101	91
198[illegible]	723	102	621	–	–	–	224	44	180	916	167	749	480	36	444	252	81	171
Predoctoral	353	–	353	–	–	–	63	–	63	127	1	126	281	–	281	69	–	69
Postdoctoral	370	102	268	–	–	–	161	44	117	789	166	623	199	36	163	183	81	102
198[illegible]	640	86	554	105	16	89	189	35	154	825	130	695	434	35	399	251	77	174
Predoctoral	308	–	308	23	–	23	56	–	56	144	–	144	272	–	272	85	–	85
Postdoctoral	332	86	246	82	16	66	133	35	98	681	130	551	162	35	127	166	77	89

See footnote on first page of table.

(Continued)

Table 40 (Cont.)

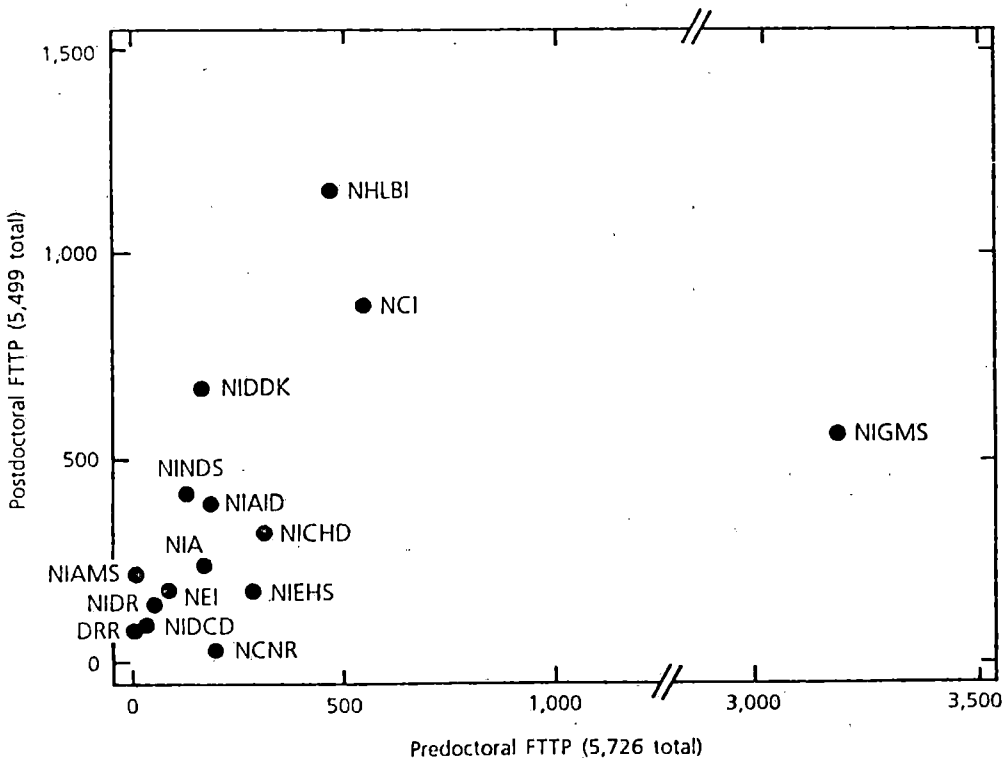
Number of NIH Full-Time-Equivalent Training Positions (FTTP)* by Academic Level, NIH Component, and Type, Fiscal Years 1980–1989

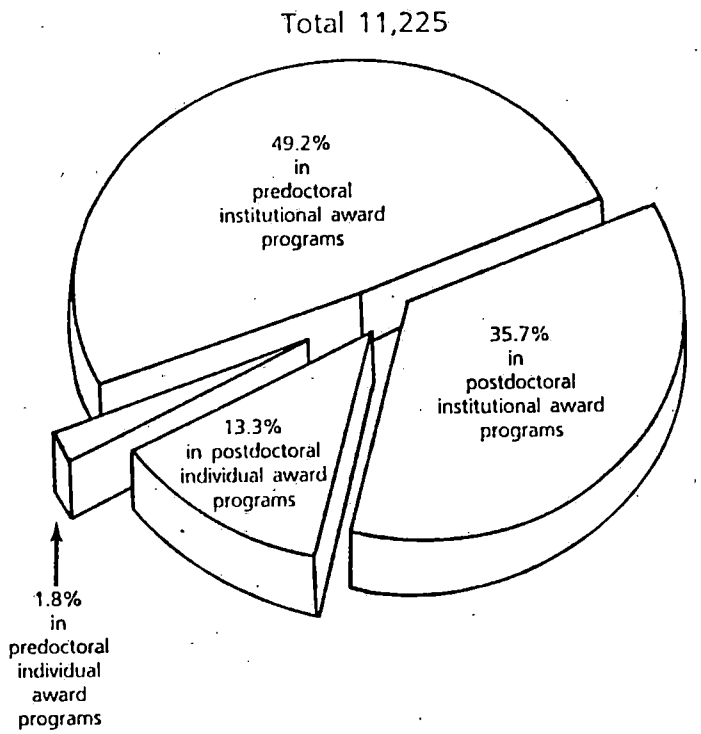
Fiscal year and academic level	NIGMS			NHLBI			NINCDS			NINDS			DRR			NCNR		
	Total	Indiv.	Inst'l	Total	Indiv.	Inst'l	Total	Indiv.	Inst'l	Total	Indiv.	Inst'l	Total	Indiv.	Inst'l	Total	Indiv.	Inst'l
1980	3,765	386	3,379	1,549	249	1,300	470	193	277	–	–	–	31	1	30	–	–	–
Predoctoral	3,151	16	3,135	370	–	370	81	–	81	–	–	–	–	–	–	–	–	–
Postdoctoral	614	370	244	1,179	249	930	389	193	196	–	–	–	31	1	30	–	–	–
1981	3,921	362	3,559	1,634	225	1,409	497	222	275	–	–	–	32	1	31	–	–	–
Predoctoral	3,330	21	3,309	408	–	408	84	–	84	–	–	–	1	–	1	–	–	–
Postdoctoral	591	341	250	1,226	225	1,001	413	222	191	–	–	–	31	1	30	–	–	–
1982	3,679	375	3,304	1,602	202	1,400	507	219	288	–	–	–	35	2	33	–	–	–
Predoctoral	3,145	26	3,119	424	–	424	84	–	84	–	–	–	1	–	1	–	–	–
Postdoctoral	534	349	185	1,178	202	976	423	219	204	–	–	–	34	2	32	–	–	–
1983	3,713	417	3,296	1,626	210	1,416	576	240	336	–	–	–	37	3	34	–	–	–
Predoctoral	3,155	34	3,121	447	–	447	103	–	103	–	–	–	1	–	1	–	–	–
Postdoctoral	558	383	175	1,179	210	969	473	240	233	–	–	–	36	3	33	–	–	–
1984	3,581	419	3,162	1,688	219	1,469	565	213	352	–	–	–	36	3	33	–	–	–
Predoctoral	3,067	51	3,016	443	–	443	109	–	109	–	–	–	1	–	1	–	–	–
Postdoctoral	514	368	146	1,245	219	1,026	456	213	243	–	–	–	35	3	32	–	–	–
1985	3,396	502	2,894	1,709	210	1,499	623	253	370	–	–	–	39	4	35	–	–	–
Predoctoral	2,820	50	2,770	465	–	465	109	–	109	–	–	–	–	–	–	–	–	–
Postdoctoral	576	452	124	1,244	210	1,034	514	253	261	–	–	–	39	4	35	–	–	–
1986	3,238	443	2,795	1,633	188	1,445	581	180	401	–	–	–	36	3	33	165	151	14
Predoctoral	2,743	59	2,684	459	–	459	120	–	120	–	–	–	–	–	–	151	141	10
Postdoctoral	495	384	111	1,174	188	986	461	180	281	–	–	–	36	3	33	14	10	4
1987	3,566	556	3,010	1,666	193	1,473	653	212	441	–	–	–	41	3	38	167	131	36
Predoctoral	2,946	60	2,886	460	–	460	135	–	135	–	–	–	–	–	–	154	127	27
Postdoctoral	620	496	124	1,206	193	1,013	518	212	306	–	–	–	41	3	38	13	4	9
1988	3,587	490	3,097	1,655	218	1,437	640	210	430	–	–	–	67	4	63	186	131	55
Predoctoral	3,031	62	2,969	451	–	451	128	–	128	–	–	–	–	–	–	160	120	40
Postdoctoral	556	428	128	1,204	218	986	512	210	302	–	–	–	67	4	63	26	11	15
1989	3,702	480	3,222	1,628	188	1,440	–	–	–	546	179	367	73	3	70	219	150	69
Predoctoral	3,158	60	3,098	456	–	456	–	–	–	119	–	119	–	–	–	187	137	50
Postdoctoral	544	420	124	1,172	188	984	–	–	–	427	179	248	73	3	70	32	13	19

See footnote on first page of table.

Figure 40.1

Number of NIH Full-Time-Equivalent Training Positions (FTTP)* by Academic Level, NIH Component, and Type, Fiscal Year 1989





*Based on year of funding. Excludes FIC F05, F06, and F15 fellowships and NLM training programs.

Source: Division of Financial Management

NRSA

National Research Service Award (NRSA) {grad}

This Congressionally mandated program provides awards to individuals and institutions to support the training of students in the biomedical sciences. Individual awards are considered fellowships. Institutional awards are traineeships. The majority of these awards are pre- and post-doctoral; however, the MARC program -- a component of the NRSA program -- offers undergraduate institutional and faculty individual awards.

Predoctoral Individual NRSA -- F31-- Provides predoctoral individuals with supervised research training in specified health and health-related areas leading toward the research degree (e.g., Ph.D.).

MARC Predoctoral Fellowships -- F31 -- Awarded on a highly competitive basis to distinguished graduates of the MARC Honors Undergraduate Research Training Program to help cover living expenses for these students while they pursue research leading to the Ph.D. in a biomedical science.

MARC NRSA Faculty Fellowship -- F34 -- Provides fellowships to selected faculty members from minority institutions to enable them to obtain advanced training in specified health and health-related areas. [1]

MARC Visiting Scientists Fellowships -- F36 -- Strengthens research and teaching programs in the biomedical sciences for the benefit of students and faculty by drawing upon the special talents of scientists of other institutions.

Institutional NRSA -- T32 -- Enables institutions to make NRSA to individuals selected by them for predoctoral and postdoctoral research training in specified shortage areas.

NRSA Medical Scientist Training Program [NIGMS/NIH]: Provides grants to universities and their medical schools so that highly motivated students having outstanding potential for a research and academic career may obtain integrated scientific and medical training leading to the combined M.D.-PH.D. degree.

NRSA Minority Institutional Research Training Grants [NHLBI/NIH]: Supports predoctoral and postdoctoral research training in areas related to cardiovascular, pulmonary or hematologic diseases at minority institutions. The minority institutions cooperate with a research center that has well-established research and research training programs to provide the research training. [1]

Institutional Research Training Awards: Minority Supplements [NCNR/NIH] :
NEED DEFINITION

NRSA Short-term Research Training -- T35-- Provides individuals with research training during off-quarters or summer periods to encourage research careers and/or research in areas of national need.

NRSA MARC Ancillary Training Activities Grant -- T36 -- Increases the number of well-trained minority scientists in biomedical disciplines and strengthens the research and teaching capabilities of minority institutions through a variety of training mechanisms, such as visits by experienced scientist to minority institutions and workshops/conferences designed to enhance the research training experience of students/faculty from minority institutions. [1]

NRSA Intramural Individual Postdoc Fellows -- F35 {Post-doc}

Supports individual research health scientists, research clinicians, and other postdoctoral trainees in receiving research training in the intramural NRSA research training program.

National Research Service Award (NRSA) {post-doc}

Postdoctoral Individual NRSA -- F32 -- :Provides postdoctoral research training to individuals to broaden

their scientific background and extend their potential for research in specified health-related areas.

NRSA for Senior Fellows -- F33 --: Provides opportunities for experienced scientists to make major changes in the direction of research careers, to broaden their scientific background, to acquire new research capabilities, to enlarge their command of an allied research field, or to take time from their regular professional responsibilities for the purpose of increasing their capabilities to engage in health-related research.

MARC NRSA Faculty Fellowship -- F34 -- same as undergrad

MARC Visiting Scientists Fellowships -- F36 -- same as undergrad

Institutional NRSA -- T32 -- same as undergrad

NRSA Minority Institutional Research Training Grants [NHLBI/NIH]: same

Institutional Research Training Awards: Minority Supplements [NCNR/NIH] : same

NRSA Short-term Research Training -- T35-- same

NRSA MARC Ancillary Training Activities Grant -- T36 -- same

1. Minority program

Report of the Advisory Committee to the Director, NIH

Review of the National Institutes of Health

Research Training Programs

(Clipped in the back of this briefing book.)

Association of Medical School Pediatric Department Chairmen, Inc.

PEDIATRIC SCIENTIST TRAINING PROGRAM

In March, 1984, in response to a growing concern on the part of its membership, The Association of Medical School Pediatric Department Chairman, Inc. (AMSPDC) established a Task Force to explore the perceived shortage of trained physician scientists in academic pediatrics. The Task Force was composed of representataive pediatric department chairs and established pediatric scientists. With the enthusiastic support of the National Institutes for Child Health and Development, the American Pediatric Society and the Society for Pediatric Research, and with funding support from the March of Dimes Birth Defects Foundation, Ross Laboratories, Mead Johnson, the American Board of Pediatrics, and individual pediatric departments, the Task Force coordinated a data base and identified three broad areas for study: entry level, training, and research support issues. In the Fall of 1985, the results of the Task Force deliberations were developed in final written form.

The Pediatric Scientist Training Program is designed to bring basic science into specialty areas of pediatrics and provide a cadre of entry-level young faculty whose goals are to continue their clinical activities in a subspecialty area but who are also prepared to continue academic research endeavors. A unique collaborative program of support for post-residency research training in basic science was proposed and a formal grant proposal for funding trainees was submitted to the NIH in October 1, 1985. The NIH grant was funded and formal training of the first group selected began July 1, 1987.

The NIH grant funds four positions annually for the five year term of the grant. The Program includes a consortium of private foundations which provide an equal number of fellowship positions. Major commitments to fund training positions have been made by the March of Dimes Birth Defects Foundation, St. Jude Children's Research Hospital, The Cystic Fibrosis Foundation, the William T. Grant Foundation, the American Academy of Pediatrics, and the Johnson and Johnson Institute for Service to Pediatrics.

This Program recruits M.D.s who plan to continue a commitment to clinical problems while pursuing a research career. It thus provides an opportunity to insure that some of the brightest investigators of the future will work on problems related to child health, and it should enable them to do so with the most current scientific tools.

Program policy is set by a Steering Committee which is composed of members of the original Task Force, representatives of AMSPDC, and representatives of those agencies which fund training positions. A Selection Committee of members comprised of four PSTP review nominees of AMSPDC (not necessarily chairman), four members of the Steering Committee, and representative scientists from four areas of basic research: molecular biology, cell biology, developmental biology, and neuroscience.

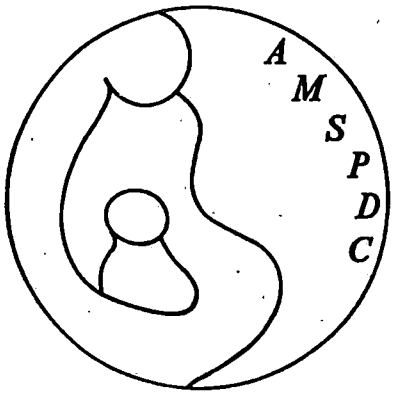
The Evaluation Committee of five is comprised of representatives named by the American Pediatric Society and the Society or Pediatric Research and an ex officio member representing the National Institutes for Child Health and Development. The Evaluation Committee reviews the Program as it is reflected in the training and career development of Program trainees.

The Program has completed selection of Fellows for academic years 1987, 1988, 1989, and 1990.

Pediatric Scientist Training Program, Box B-199
University of Colorado Health Sciences Center
4200 East Ninth Avenue
Denver, Colorado 80262

PEDIATRIC SCIENTIST

TRAINING PROGRAM



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PROGR. ESCRIPTION

This Program supports a postdoctoral career development training program which is administered by the Steering Committee of the Pediatric Scientist Training Program of the Association of Medical School Pediatric Department Chairmen, Inc. (AMSPDC) in collaboration with the National Institute of Child Health and Human Development (NICHD) and various private foundations and institutions. Its goal is to insure that pediatric scientists receive at least two years of basic science research training in highly renowned research universities. The Program actually involves five years of training: three years funded by a sponsoring institution and two years of basic research training funded by this Program. The three years funded by the sponsoring institution would include one year of clinical fellowship training and two years of a junior faculty position with at least 75% time free for research under an identified preceptor. The two years of basic research training funded by this Program are pursued in a laboratory selected by the applicant and/or nominating chairperson for review by the Selection Committee.

At the completion of the training it is anticipated that the candidates will be competitive for research funding of various types following entry to the junior faculty level position.

This Program represents a novel response to a generally perceived shortage of young pediatricians with research expertise. It provides an opportunity to insure that some of the brightest investigators of the future will work on problems related to child health, and it should enable them to do so with the most current scientific tools. Ultimately, these scientists, dedicated to continuing basic and clinical research, will be the interpreters of the appropriate application of basic research advances to the better clinical care of children.

AMSPDC TASK FORCE 1984-1986

Report

In response to a growing concern on the part of its membership, The Association of Medical School Pediatric Department Chairmen, Inc. established a task force in early 1984 to explore the perceived shortage of trained pediatric scientists. The number of physicians receiving postdoctoral

research training is diminishing. A survey of gradua .nedical students conducted by the Association of American Medical Colleges in 1980 revealed that the number of medical school graduates indicating research as their first career choice declined from 39% in 1960 to 21.8% in the survey year. That this continuing decline is of great concern to the leadership of the National Institutes of Health (NIH) has been voiced repeatedly by the Director and his various advisory committees. Similarly, an Institute of Medicine/National Academy of Sciences Committee stated, "The Committee has expressed concern about the lack of interest in research careers on the part of young physicians." (Personnel Needs and Training for Biomedical and Behavioral Research, 1984 report, N.A.S.)

Even more impressive is the decline in young academic physicians, presumably trained in research, who receive an NIH Individual Research Grant (RO1). A decade ago the ratio of RO1 awardees was approximately one M.D. to one Ph.D. Over the last several years this ratio has completely inverted to approximately one M.D. award for every three Ph.D. grants. In June 1984 Dr. Charles Sherman, Special Assistant to the Director's Advisory Committee, summarized eight years of data from the NIH Consolidated Grant Application File comparing M.D.s, Ph.D.s and M.D.-Ph.D.s with regard to the success of their first individual research grant application. Ph.D.s and M.D.-Ph.D.s were virtually identical in the percentage of first RO1 applications which were awarded funds: 36.2% and 35.3%, respectively. On the other hand, only 28% of M.D. applicants received funds. This ratio is presumably worse today since Dr. Sherman's survey was weighted in the 1970s when, as stated above, the M.D./Ph.D. award ratio was far higher than it is presently. The diminished physician success rate for first-time RO1 awards was not due to bias based on innate personal characteristics of the two groups since the percentage of first-time grant awardees who received money on their second application was the same: 44.1% for Ph.D.s, and 43.7% for M.D.s.

Certainly, the reasons for these results are multifactorial. For example, at the 48th meeting of the Advisory Committee to the Director (December 14, 1983) Dr. Wyngaarden noted that:

> "Debt loads have probably excluded some potentially successful scientists from entering clinical research training programs. The increasing complexity of science and the more demanding requirements of dual competence in

> m , and science and the uncertainty of stable careers are discouraging."

Fueled by these statistics indicating that physicians have difficulty competing for research grants, the discouraging specter of uncertain "stable careers" in academic departments is, perhaps, more prevalent than heretofore documented.

Nonetheless, there is uniform agreement that a major, if not most significant, factor which impairs the physician-scientist's ability to compete effectively with the Ph.D. scientist is lack of sufficient basic research training. Most clinical training programs are of two years duration where one year is spent in patient care activities required to satisfy subspecialty board requirements. Dr. Wyngaarden has called this the "toe-in-the-water" approach which has "become progressively less effective as a way of fostering M.D. researchers in an age of increasing scientific complexity." (Science 223:149, 1984)

The data bear this out. In the Director's Advisory Committee meeting cited above, Dr. Sherman demonstrated a strong relationship between the duration of research training and the likelihood of a physician receiving a grant. Specifically, only 10-12% of M.D. postdoctoral trainees who received less than one, between one and two, or between two and two-and-one-half years of training were successful in receiving a NIH grant. This fraction rose to about 25% for those training for two-and-one-half to three years, and to approximately 33% for those whose research experience exceeded three years prior to applying for a grant.

Conceivably, circumstances are even worse in pediatric training situations. Data prepared by the NICHD for the AMSPDC Task Force in July 1984 showed that the NICHD had to fund 4.5 M.D. postdoctoral research fellowship grants to "produce" one NICHD research grant award from this group. For Ph.D. postdoctoral research fellows, the proportion was virtually identical, 4.8:1. On the other hand, by the conventional training grant mechanism, NICHD had to "train" 17.7 postdoctoral physician trainees in order to "produce" one NICHD research grant award. Furthermore, out of the approximately 125 pediatric departments nationwide, ten receive about half the grants and three-quarters of the research funds awarded by NICHD to pediatric departments. On the funding list the bottom 75 departments barely get 20% of the grants.

We contend that the lack of trained physician-sc · · · a academic pediatrics has reached crisis proportions. A questionna.. ..istributed by the AMSPDC Task Force in early 1985 and returned by more than half of thepediatric departments demonstrated that there was no shortage of available academic positions but rather a "shortage of good people" which was ranked above "lack of start-up funds" and "lack of research funds" by department chairmen as presenting "significant difficulty in recruiting investigatively-oriented faculty".

We agree with the position of a recent ad hoc NIH Committee on Clinical Research Training which recommended establishment of a Progressive Training Pathway and stated:

> "It is almost implicit in the nature of training Ph.D. scientists that training take place in more than one laboratory over the course of pre- and postdoctoral training. Such an eclectic exposure to research approaches is seen in the background of many successful physician scientists. Accordingly, it is proposed that as an additional step or option in the advanced training program an opportunity be provided for research training in another laboratory for up to two years.

In our opinion as well, this precise mechanism forms the basis for addressing both the problem of providing rigorous basic research training for young pediatrician-scientists and the inability of at least half the country's pediatric departments to supply such training in their subspecialty training programs.

Recommendations

While the Task Force realized that no single solution to the problem of developing physician investigators competent in basic research training at the postdoctoral level after completion of clinical residency training exists, after one-and-one-half years of study it identified postdoctoral research training as the area of career development which most needed strengthening for the development of academic pediatric scientists. The Pediatric Scientist Training Program was designed to bring basic science into specialty areas of pediatrics and provide a cadre of entry-level young faculty well prepared for academic research endeavors. It is a unique collaborative program supported by institutional, private, and governmental funds to assure

adequate t esearch training, clinical experience to establish subspecialty competence, and guarantee of a subsequent academic position on completion of the Program.

PROGRAM DESIGN

The Program establishes a total of five years of support for individuals with only a M.D. degree who aim to devote themselves to academic careers in pediatrics -- careers with a strong research component. The candidates are selected during residency or chief residency training in general pediatrics. Candidates must be nominated for Program Fellowships by the chairperson of the department in which residency training is pursued. For those candidates selected, the following training is provided:

1. Two years of basic research training in a subspecialty area of pediatrics. It is preferred that this training be provided by senior scientists in basic science departments. In most instances this training would be offered at a different university than that providing residency training. It is a requirement of the Program that the two years of basic research training be uninterrupted and devoted to full-time work in the laboratory. These are the only years of training funded by the Program.

2. One year of clinical fellowship training in a subspecialty area to provide trainees with sub-board eligibility. Support for this training is the responsibility of the trainee's nominating or sponsoring department.

3. A position at a junior faculty level at a sponsoring institution which would provide the salary for the position for at least two years. The PSTP Fellow is free to accept such a position in the academic department of his/her choice. This position must insure 75% time for research. The remaining 25% time could be spent in teaching and clinical service. The funding for these two faculty years can be

provided by the sponsoring institutions in a y ways including successful competition for young faculty awards.

The Program identifies pediatric residents by a competitive application process. Four of these new starting physicians each year are funded by the NICHD with additional fellowships sponsored by The March of Dimes Birth Defects Foundation, St. Jude Children's Research Hospital, the Cystic Fibrosis Foundation, The William T. Grant Foundation, the American Academy of Pediatrics, and other organizations. A full stipend of $30,000 for the first year and $32,000 in the second year is provided, and an award of $10,000 to the training laboratory is made to support laboratory expenses each of these two years.

Applicants must be nominated by the chairperson of the medical school pediatric department in which the candidate receives residency training. In addition, the applicant must be sponsored by a department (which may or may not be the same department of residency training) which undertakes a commitment to the candidate to insure that the trainee completes all necessary subspecialty training. This sponsoring department must have available a junior faculty position guaranteed for two years in which the majority of time will be committed to research activities. The trainee will not be bound to return to the sponsoring institution but will be free to consider competing offers from other universities willing to provide the two years of faculty support with 75% time protected for research and appropriate preceptors who will provide the best environment for continued research development.

ADMINISTRATION OF THE PROGRAM AND FINANCIAL ARRANGEMENTS

Program policy is set by a Steering Committee which is composed of members of the original Task Force, representatives of AMSPDC, and representatives of those agencies which fund training positions. A Selection Committee of twelve is comprised of four nominees of AMSPDC (not necessarily chairpersons), four members of the Steering Committee, and representative scientists from four areas of basic research: molecular biology, cell biology, developmental biology and neuroscience. The Evaluation Committee reviews the Program as it is reflected in the training and career development of Program trainees. This Committee of five is

comprised of representatives named by the American Pediatric Society and the Society for Pediatric Research and an *ex officio* member representing the National Institute for Child Health and Development. The Program office is located in the department of pediatrics on the University of Colorado Health Sciences Center campus.

The Dean of the University of Colorado School of Medicine has agreed that grants to AMSPDC are processed through the Office of Grants and Contracts of the Health Sciences Center so that a full financial record and audit trail can be provided to the Secretary/Treasurer of AMSPDC and all funding institutions. Fellows' salaries and expenses are administered through their approved training institutions.

APPLICATION AND NOMINATION PROCEDURE

Applications are due on February 1 of the year preceding the fellowship start date which is July 1. Application forms are available upon request from September 15 of the year preceding the February 1 deadline. Advising and direction in the choice of research mentors and laboratories are available to every applicant and nominating chairperson.

An original and fifteen copies of the application, compiled in the precise order listed below, must be submitted by February 1 of the year preceding the training start date:

1. The application forms which include the name of applicant, nominating and sponsoring chairmen, residency information and name of research mentor and laboratory site.
2. Statement from applicant including proposed research and clinical subspecialty plans.
3. Statement from the nominating chairperson.
4. Statement of support commitment from sponsoring chairperson, if different from nominator.
5. Letter from proposed research mentor.
6. Mentor's NIH grant application Biographic Sketch (short form).
7. Applicant's curriculum vitae listing publications, honors and awards.
8. Applicant's medical school record.
9. Letters of reference (3).

SELECTION PROCEDURE

The PSTP Steering Committee screens candidates proposed by pediatric departments throughout this country and Canada and narrows the list to no more than twenty to be invited for interviews. The interviews are conducted by the Selection Committee at the annual American Pediatric Society / Society for Pediatric Research meetings each spring. Thus, residents being interviewed may also attend the pediatric research meetings. Travel expenses to the meetings for interview are the responsibility of the nominating department of pediatrics.

The Selection Committee considers each application in light of the following criteria: the quality of the proposed training laboratory and experience; the anticipated quality of career guidance and mentoring by sponsoring department and laboratory mentor; the applicant's commitment to a career in academic pediatrics; a commitment to scholarly and scientific endeavor; intellectual curiosity, thoughtfulness, and creativity and personal academic achievement of the applicant.

REVIEW AND EVALUATION

The Steering Committee reviews the candidates' continued development and acts to insure the continued commitment by the sponsoring department as required by this Program, that is, the provisions of the clinical fellowship training and of the entry level faculty position with sufficient research time. Annual reports and evaluations are required from trainees and research mentors. Each spring at the annual meeting of the Association of Medical School Pediatric Department Chairmen, Inc., second year fellows present brief oral summaries of their research and meet individually with the Evaluation Committee for a review of research experience and career development plans.

TRAINING

All of the laboratories selected to provide training should have outstanding reputations and a long history of funding. Training must be directed by senior scientists, and it is preferable that research mentors be located in basic science laboratories, although senior clinical scientists will also be

considered. An important element of the Program is the principle of relocation from the site of residency training to another institution for research training.

CRITERIA FOR APPLICATIONS AND FELLOWSHIPS

1. Applicant must be in year 2, 3, or chief residency of a general pediatric residency.
2. Resident must be nominated by his/her pediatric department chairman.
3. M.D./Ph.D.s are <u>not</u> eligible.
4. Sponsoring department (which may or may not be the same as the nominating department) commits to funding clinical component of fellowship training and a junior faculty position for two years with 75% time free for research.
5. Training should be pursued in a basic science laboratory, preferably away from residency training site.
6. Candidates must be U.S. citizens, permanent residents, or Canadian citizens.
7. No clinical responsibilities are allowed during the two years of research training.
8. Counselling in the choice of laboratory mentor and site is available to every applicant.
9. Due date for applications is February 1 of the year preceding fellowship start date and are available upon request from the Program office.
10. Selection Committee interviews candidates and meets each year at the annual American Pediatric Society / Society for Pediatric Research meetings.

STIPENDS

<u>First Year</u>: $30,000 salary plus fringe benefits; $10,000 to the research mentor's laboratory for supplies, equipment and travel.

<u>Second Year</u>: $32,000 salary plus fringe benefits; $10,000 to the research mentor's laboratory for supplies,
equipment and travel.

<u>STEERING COMMITTEE</u>

Task Force Representatives
Frederick C. Battaglia, M.D., Univ. of Colorado
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Larry J. Shapiro, M.D., UCLA-Harbor
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Joseph B. Warshaw, M.D., Yale University
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Charlotte Catz, M.D.

March of Dimes Representative
Samuel J. Ajl, Ph.D.

Cystic Fibrosis Representative
Robert J. Beall, Ph.D.

St. Jude Children's Research Hospital Representative
Joseph V. Simone, M.D.

The William T. Grant Foundation Representative
Robert J. Haggerty, M.D.

American Academy of Pediatrics
Richard M. Narkewicz, M.D.

National Center for Nursing Research
Career Development Awards

In 1987 the National Center for Nursing Research (NCNR) announced the availability of two Career Development Awards -- the Academic Investigator Award (K07) and the Clinical Investigator Award (K08) -- to strengthen the research careers of nurse scientists. Applicants for both awards have been nurse scientists who have had sufficient research experience and background (generally 4 - 10 years beyond the doctorate) so that time released from teaching and administrative duties and devoted to research would assure the development of highly qualified nurse investigators. Awards for both mechanisms have been 3 - 5 years in length with 75% effort committed for the research project. Allowable direct costs could not exceed $60,000 a year with a maximum salary of $40,000 per year plus related fringe benefits and research expenditures up to $20,000 direct costs. The flexibility within the Academic Investigator Award has allowed nurse scientists the freedom to select sponsors (and cosponsors) from within their local universities as well as from universities all across the United States. Of the two grant mechanisms, the Academic Investigator Award has provided the nurse scientists with the greatest opportunity to develop their own specific program of research. Consequently, many more Academic Investigator Awards have been granted then Clinical Investigator Awards.

To provide the nursing community with updated information, the National Center for Nursing Research is currently revising the guidelines for both awards. The awards now will be limited to 3 years with 75 - 100% committed effort. Allowable direct costs will be increased to $70,000 a year with a maximum salary of $50,000 per year plus related fringe benefits and research expenditures up to $20,000 direct costs. Sponsors (and cosponsors) are still required. Curriculum development is still <u>not</u> an appropriate component of the Academic Investigator Award application. There is an increased selection of GCRC and NIH funded research centers available for Clinical Investigation Award applicants, including the two research centers funded by the National Center for Nursing Research.

Eligibility for the two awards also has be revised. Nurse Scientists now must be between 4 - 8 years beyond the doctorate. Nurse scientists now are allowed to be principal investigators on R01, R29, or R15 grant mechanisms. New graduates (0 - 2 years beyond the doctorate) are still ineligible to apply for either award. The National Center for Nursing Research would like to implement a new Career Development Award for this special category of novice nurse researchers but, fiscal restraints have limited its implementation at the present time.

National Center for Nursing Research
Minority Supplement

The nursing community has been very responsive to the NIH announcement (in the April 21, 1989 issue of the NIH Guide for Grants and Contracts) encouraging principal investigators of research project grants and program project grants to recruit minority students and minority faculty members on to their grants. Inquiries about the NIH announcement has lead to very competitive applications requesting support for minority undergraduate students, graduate students, and minority faculty members to be submitted to the National Center for Nursing Research. More applications were received in FY 1990 than monies were available to fund. Applications placed on the approved unfunded list now are being selected and awarded with current FY 1991 monies. New minority supplement applications are continuely being submitted to the National Center for Nursing Research.

To enhance research training opportunities for minority graduate students, the National Center for Nursing Research has encouraged the principal investigators of its NRSA Institutional Training Grants (T32) to request up to 3 additional positions per fiscal year on their grants for minority students. Again, the nursing community has been very responsive and almost all of the requests have been funded after careful review of the submitted supplement application by the senior staff of the Division of Extramural Program, NCNR.

AAPMR/AAP JOINT RESEARCH COMMITTEE REPORT #1-B

GUIDELINES FOR PROGRAMS FOR TRAINING PHYSICIAN INVESTIGATORS IN PM&R

William M. Fowler, Jr., Paul Bach-y-Rita, Walter C. Stolov
1/22/86

It has long been acknowledged that rehabilitation research in general, has not been successful in fulfilling its objectives of providing a foundation of knowledge for rehabilitation practices and is not viewed as an important priority in the health research area. An excellent review of the problem of lack of rehabilitation research productivity (quantity) and excellence (quality) was presented by Fuhrer in his 1981 ACRM Presidential Address [11], and Fowler in his 1981 AAPMR Presidential Address[10]. This important topic has also been the subject of intensive investigation since 1981 by the AAPMR/AAP Joint Research Committee which has generated seven position papers[2-9], five research newsletters[9], and four reports[8].

As outlined in several Joint Research Committee reports [8] (1982, 1984, 1985) methods to increase research productivity cover the areas of: (a) developing the capacity of academic departments to do research, (b) improving grantsmanship skills, (c) stimulating current faculty, especially physiatrists, to do research, and (d) attracting and training future investigators. Attracting and training future investigators includes: (a) stimulating PM&R residents to be interested in research during their residency[3], (b) encouraging residents who show research potential to obtain fellowships [2,6], and (c) identifying programs of research excellence to which interested and qualified individuals can be directed[7]. The consensus of opinion appears to be that the major reason for a lack of research productivity among physiatrists is the lack of suitable training opportunities necessary for physiatrists to become independent investigators [10,17]. Stolov[16], for example, in an excellent review regarding rehabilitation research training, has estimated that the desired increase in research productivity could be achieved if each year for the next five to ten years just 20 physiatrists were trained in rehabilitation research.

A lengthy list of publications and reports have clearly shown that: (a) there has been a marked decline in resident physiatrists going into academics and research areas during the past 12 years [14,17], and (b) the amount of time spent by physiatrists on research is extremely low[1,10,14,17] and is decreasing[12,13,14]; the most recent review (AAP/AAPMR Research Newsletter, #5, 1985) shows that there was a decline in time spent on research by 11% between 1968 and 1979 and by another 16% between 1979 and 1985. Fifty-eight percent of physiatrists spend no time in research while only 2.7% spend greater than 21% time[13]. In one survey, two-thirds of the respondents reported less that five publications during their academic career[13]. Other surveys have shown that 41% of those responding had not made a grant application during the past six years[15], and that a relatively few physiatrists carry on the research burden for many[10,13]. In all these surveys, however: (a) a perceived need for research productivity was expressed, and (b) a major reason given for the lack of research productivity was unfamiliarity with the research process (e.g., lack of training in research).

GENERAL GUIDELINES FOR PROGRAMS

Regardless of type, all programs should contain the following components.

Program Design

1. Training Program Description: If an apprentice type model is used, the program should at least describe the research core area (e.g., Neuromuscular Diseases, SCI, Neurophysiology, etc.) and the tracks (e.g., clinical, pre-clinical, mixed) available at the institution, as well as a preceptor/preceptee system. If a formal model is used, more specific detail is necessary (e.g., courses, specific yearly goals, etc.)

2. Research Development Plan for Fellow: Candidates accepted for a research career development award, in conjunction with their preceptor, should be required to generate a specific research development plan, within one of the available core areas, by the end of the first quarter of their fellowship; the plan elements to consist of:

   - The specific problem intended for study during tenure of the fellowship (purpose, objectives).
   - The methodology to be used, including experimental design.
   - Rationale for and justification of the study.
   - Major findings that constitute the background of the proposed research, including references.
   - Potential problems and alternative approaches to overcome them.
   - Decisions governing choice of any experimental animals or human subjects.
   - Length of fellowship.
   - Courses to be taken, if any.
   - Plans, if any, to meet requirements of advanced degree in relevant academic field (e.g., Physiology, Biomedical Engineering).
   - Respective contributions to study by fellow, preceptor, and others.
   - Plans for the future.

3. Role of Preceptor: If the proposed program is based primarily on the apprentice approach with assignment to a specific research laboratory (pre-clinical tracks) or faculty person (clinical tracks) the preceptor to whom the fellow is assigned has a major role in the success of the fellow's study and the program per se. The preceptor should be directly involved in the:

- Selection of candidates
- Development of the fellow's research development plan.
- Selection of courses to be taken.
- Supervision of fellow's research.
- Periodic evaluation of fellow's program towards meeting stated objectives of his/her study.
- Formulation of the fellow's future academic career.

Duration of Fellowship: Programs should be provided at least up to three years of training and direct experience in rehabilitation research. For persons in a clinical track, a minimum commitment should be one year with potential for renewal to a maximum of three years. For persons in a pre-clinical track, the minimum commitment should be two years, renewable to a maximum of three years.

Clinical Involvement: If permitted by agency and institutional regulations, the fellow's academic research development plan should include research and research training requiring at least 75% of time and effort. Related clinical and teaching activities not to exceed 25% time and effort could be allowed by the training program director.

Selection of Candidates: Specific eligibility requirements should be clearly defined and made known to the candidate before acceptance to the program. Individuals with clinical training should be expected to have the terminal degree for their appropriate profession. In most instances physicians will be expected to have completed their post graduate specialty training. However, it is possible that a person could wish to have research experience prior to starting their post graduate specialty training. Individuals in the clinical track should have credentials acceptable for those at similar levels of professional training at the institution.

Candidates who apply should be required to complete an application form (See Attachment for example). Selection criteria should be clearly defined with an emphasis on the applicant's: (1) research career goals, (2) training goals during period of award, and (3) research plan.

Evaluation of Fellows: A specific plan should be designed to evaluate fellows during and after their fellowship.

Training and research experience during the fellowship period should be periodically evaluated primarily in terms of progress made towards meeting the objectives of the fellow's research plan and his/her training goals. Fellows should also be required to submit final reports. Each report should contain at a minimum an analysis of the significance of the project and an assessment of the degree to which the objectives of the project have been achieved.

Post Fellowship (Long-Term): Outcomes of the training and experience obtained during the fellowship should also be evaluated, by follow-up of each fellow's professional career in terms of:

- Obtainment of research career goals established by fellow at beginning of fellowship.
- Publications.
- Papers presented.
- Jobs obtained:
  - type of organization (e.g., academic, etc.)
  - type of work (e.g., research, training, etc.)

TYPES OF PROGRAMS

There are several approaches to developing a program for training investigators. In some institutions, a tightly structure program is used either with: (1) formal modules in specific areas linked to didactic instruction in statistics, instrumentation, etc[18], on (2) a formal M.S./Ph.D. program (Departments PM&R, University of Washington and University of Minnesota, etc.). Other programs are informal, non-structured, apprentice (mentor)-type research experiences of the type advocated by the National Institutes of Health (NIH). Discussions with senior Institute administrators at the NIH indicates that the most successful programs do not have formal course work but rather an intense research immersion experience, primarily in excellent research laboratories. Indeed, the NIH institutional training grant application guidelines only stress resources and key personnel. A third approach, is a partially structured program utilizing: (1) modules (cores and tracts) in specific areas, and (2) an apprentice-type research experience.

Apprentice Type Program

Young physiatrists interested in investigation will, for the most part, be interested in developing expertise in clinical research. While a small number may wish to become laboratory research scientists following residency training, the majority of basic laboratory physician-scientists will have received research training before clinical training. Thus, these comments on a generic model of a program for training physician-investigators in PM&R are directed primarily toward the preparation of clinical research capabilities.

Candidate Selection

Candidates for the fellowship should show a strong interest in research. A background that includes research experience is desirable, but not essential. Most important is evidence of independent thinking and a strong interest in the mechanisms underlying disease processes and rehabilitation procedures.

Length and Timing of the Research Experience

A research fellowship should provide 3 to 5 years of training and experience. The experience should either follow the residency, or be interdigitated with the PM&R residency. If interdigitated, it could commence after the transitional year and the first year of residency training. The fellow would then spend two years in research, return to the clinical setting to complete the residency, and then spend three years in full time research, except for up to 25% time in the clinic.

Training

The primary goal of this program is to train clinician researchers. The most successful programs have been informal with a minimum, or an absence of a formal component. However, this is only possible when the laboratory environment and the mentor are excellent. In such an environment, the fellow learns each component of the research process as it is being performed. These include research philosophy, research design and methodology, data analysis and statistics, preparation of research publications and presentations, and grant writing. The evaluation of skills at each stage will occur in the laboratory setting; the mentor and other researchers will perform this on an on-going basis. The research need not be in a PM&R department in order to train excellent physician-investigators in PM&R, but could occur in any related field.

Another option that may be selected is to complete a Ph.D. during the research experience. In this case, the required coursework will be completed during the years out of the clinic.

Formal Type Program

The following is modeled after a "traditional" master of science graduate school program. Wherever administratively possible the suggestion is made that a formal degree should be considered. (See also Archives of Physical Medicine and Rehabilitation, Vol. 65, p. 54-56, 1984, "Rehabilitation Research Training", Walter C. Stolov, M.D.).

Institutional Requirements

1. A department or division of rehabilitation medicine which has at least one active researcher with an established research track record and a collegial and a professional relationship with researchers from other departments so as to insure the individual is part of a research community at his institution, or

2. A department or division of rehabilitation medicine with at least three active researchers with established research track record and

3. A department or division of rehabilitation medicine that has an academic mission in that in addition to a research requirement at its institution there is also a teaching mission and is a department with at least monthly active research seminars and journal clubs if not within its own department or division at least in association with others and

4. Location of the department or division on a campus wherein there is access to formal graduate course work for knowledge and skill attainment and a graduate school program although not necessarily with the rehabilitation medicine department in biological, medical, and physical sciences, and has library facilities equivalent to those expected at a university and has a campus administrative structure favorable for research excellence and

5. An ability by the division or department of rehabilitation medicine to identify within itself or its closely active affiliated departments areas of research in which it is most able to support research training. These areas broadly to be within physical science, medical science, and behavioral science and further within these broad groups more specific fields of subject matter excellence can be identified.

Applicant Selection

1. A selection committee of at least three established researchers, all need not be from the rehabilitation medicine department or division, who will be the committee for applicant review. This committee should be capable of recognizing amongst applicants a record and evidence of high intellectural achievement, and some specifically identifiable elements from undergraduate, medical school, or residency work of an aptitude or beginning experience in research and research related activities. The selection process also to be based on the idea of a likely effective match between the subject matter area likely to be of interest to the applicant and the subject matter areas identified within the institution wherein research training can be offered.

Trainee Counseling

1. Identification by the selection committee and its successful applicant of the area of study likely to be suitable to the trainee and likely also to have longevity for at least a period of five years after completion of research training. This longevity to be based on the area having sufficient research problems to permit the trained applicant to continue to work in his area of training.

2. Selection by the trainee and the applicant selection committee of a mentor to serve as chief advisor for the trainee throughout his entire program.

3. Appointment by the mentor and the trainee of two additional individuals to serve with the mentor as the student's advisory and research committee.

4. Selection by the trainee in conjunction with his research committee of a study program for development of the basic knowledge and basic skill base for the research area selected. This study program to be equivalent to a minimum of 27 quarter credits (a maximum of 9 credit hours per quarter), and to include at least statistical analysis, experimental design, and computer literacy plus appropriate background courses in the area selected by the trainee. Since trainees will be coming with different backgrounds, some may already have the equivalent of the basic elements.

Trainee Program

1. Year 1.

   A. Completion of the bulk of the knowledge and skill course work and study identified.

   B. Minimum of 15 hours per week as laboratory assistant or research assistant in mentor's laboratory or current research activities.

   C. Development by the trainee by the end of the first nine months of the first year of the identified specific research problem the trainee will investigate including its specific objectives, its methods, and the techniques for results analysis. Formal presentation of the proposal to the staff for critique at a research seminar and final approval by the mentor and the research committee.

   D. Active participation in the institution's monthly research and journal club seminars.

2. Year 2 (First nine months)

   A. Execution of the research project with all experimental components completed by the ninth month. Midstream presentation to the research seminar.

   B. Completion of background course work.

   C. Continued attendance at research and journal club seminars.

   D. Some element of teacher training to further prepare the student for the academic life.

3. Year 2 (Last three months)

   A. Formal write up of the research activity in the form of a manuscript suitable for submission for publication or in a thesis format as may be dictated by the school.

   B. Final presentation and defense of the research results at research seminar.

   C. Oral examination by the student's committee in the field of the students's concentration.

SUMMARY

There are several options for physician-investigator training programs in PM&R. The individual institutions should have some flexibility in determining the most appropriate option or combination of options. Some institutions have highly structured training programs; however, informal training programs have proven to be highly successful. The overriding consideration is that the trainee should be assigned to an excellent, highly productive laboratory. In

such a setting, the trainee will learn not only specific techniques, but research philsophy, methodology and design, grant and report writing, statistics and evaluation methods.

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NATIONAL INSTITUTES OF HEALTH AMENDMENTS OF 1990

49-139 - 90 (613)

Public Law 101-613
101st Congress

An Act

Nov. 16, 1990
[S. 2857]

To amend the Public Health Service Act with respect to certain programs for the National Institutes of Health.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

National Institutes of Health Amendments of 1990. Medical research. 42 USC 201 note.

SECTION 1. SHORT TITLE.

This Act may be cited as the "National Institutes of Health Amendments of 1990".

SEC. 2. ESTABLISHMENT OF NATIONAL FOUNDATION FOR BIOMEDICAL RESEARCH.

Title IV of the Public Health Service Act (42 U.S.C. 281 et seq.) is amended by adding at the end thereof the following new part:

"PART H—NATIONAL FOUNDATION FOR BIOMEDICAL RESEARCH

42 USC 290b.

"SEC. 499A. ESTABLISHMENT AND DUTIES OF FOUNDATION.

"(a) IN GENERAL.—The Secretary shall establish a nonprofit corporation to be known as the National Foundation for Biomedical Research (hereafter in this section referred to as the 'Foundation'). The Foundation shall not, except for the purposes of the Ethics in Government Act and the Technology Transfer Act, be an agency or instrumentality of the United States Government.

"(b) DUTIES.—

"(1) ESTABLISHMENT OF FUND FOR ENDOWING RESEARCH POSITIONS AT NATIONAL INSTITUTES OF HEALTH.—

"(A) The Foundation shall establish a fund whose primary purpose shall be to provide endowments for positions at the National Institutes of Health to conduct biomedical research. Such positions may be held by scientists without regard to whether the scientists are employees of the Federal Government.

"(B) In addition to the purpose described in subparagraph (A), the fund established under such subparagraph may be expended to recruit scientists to hold the positions endowed by the fund.

"(C) The purposes for which an endowment under subparagraph (A) may be expended include support for the staffing, equipment, and quarters for the biomedical research conducted by scientists holding endowed positions under such subparagraph.

"(2) APPLICABILITY OF CERTAIN STANDARDS REGARDING NONFEDERAL RESEARCHERS.—In the case of scientists holding endowed positions under paragraph (1)(A) who are not employees of the Federal Government, the Foundation shall negotiate a memorandum of understanding with the Director of the National Institutes of Health, subject to the approval of the Sec-

retary, that specifies that any such scientist shall observe the ethical and procedural standards regulating research and research finding (including publications and patents) that are followed by scientists conducting research as employees of such Institutes, including standards under this Act, the Ethics in Government Act, and the Technology Transfer Act.

"(3) ADDITIONAL DUTIES.—The Foundation shall provide for biennial audits of the financial condition of the Foundation.

"(c) BOARD OF DIRECTORS.—

"(1) COMPOSITION.—

"(A) The Foundation shall have a Board of Directors (hereafter referred to in this section as the 'Board'), which shall be composed of ex officio and appointed members in accordance with this subsection. All members of the Foundation shall be voting members.

"(B) The ex officio members of the Council shall be—

"(i) the Chairman and ranking minority member of the Subcommittee on Health and the Environment (Committee on Energy and Commerce) or their designees, in the case of the House of Representatives;

"(ii) the Chairman and ranking minority member of the Committee on Labor and Human Resources or their designees, in the case of the Senate; and

"(iii) the Director of the National Institutes of Health.

"(C) The ex officio members of the Board under subparagraph (B) shall appoint to the Council 9 individuals from among a list of candidates to be provided by the National Academy of Science. Of such appointed members—

"(i) 4 shall be representative of the general biomedical field;

"(ii) 2 shall be representatives of the general biobehavorial field; and

"(iii) 3 shall be representatives of the general public.

"(2) CHAIR.—The ex officio members of the Board under paragraph (1)(B) shall designate an appointed member of the Board to serve as the Chair of the Board.

"(3) TERMS AND VACANCIES.—

"(A) The term of office of each member of the Board appointed under paragraph (2)(C) shall be 5 years, except that the terms of offices for the initial appointed members of the Board shall expire as determined by the ex officio members and the Chair.

"(B) Any vacancy in the membership of the Board shall be filled in the manner in which the original position was made and shall not affect the power of the remaining members to execute the duties of the Board.

"(C) If a member of the Board does not serve the full term applicable under subparagraph (A), the individual appointed to fill the resulting vacancy shall be appointed for the remainder of the term of the predecessor of the individual.

"(D) A member of the Board may continue to serve after the expiration of the term of the member until a successor is appointed.

"(4) COMPENSATION.—Members of the Board may not receive compensation for service on the Board. Such members may be

reimbursed for travel, subsistence, and other necessary expenses incurred in carrying out the duties of the Board, as set forth in the bylaws issued by the Board.

"(d) INCORPORATION.—The initial members of the Board shall serve as incorporators and shall take whatever actions necessary to incorporate the Foundation.

"(e) NONPROFIT STATUS.—The Foundation shall be considered to be a corporation under section 501(c) of the Internal Revenue Code of 1986, and shall be subject to the provisions of such section.

"(f) EXECUTIVE DIRECTOR.—

"(1) IN GENERAL.—The Foundation shall have an Executive Director who shall be appointed by the Board and shall serve at the pleasure of the Board. The Executive Director shall be responsible for the day-to-day operations of the Foundation and shall have such specific duties and responsibilities as the Board shall prescribe.

"(2) COMPENSATION.—The rate of compensation of the Executive Director shall be fixed by the Board.

"(g) POWERS.—In carrying out subsection (b), the Foundation may—

"(1) operate under the direction of its Board;

"(2) adopt, alter, and use a corporate seal, which shall be judicially noticed;

"(3) provide for 1 or more officers, employees, and agents, as may be necessary, define their duties, and require surety bonds or make other provisions against losses occasioned by acts of such persons;

"(4) hire, promote, compensate, and discharge officers and employees of the Foundation;

"(5) prescribe by its Board its bylaws, that shall be consistent with law, and that shall provide for the manner in which—

"(A) its officers, employees, and agents are selected;

"(B) its property is acquired, held, and transferred;

"(C) its general operations are to be conducted; and

"(D) the privileges granted by law are exercised and enjoyed;

"(6) with the consent of any executive department or independent agency, use the information, services, staff, and facilities of such in carrying out this section;

"(7) sue and be sued in its corporate name, and complain and defend in courts of competent jurisdiction;

"(8) modify or consent to the modification of any contract or agreement to which it is a party or in which it has an interest under this subtitle;

"(9) establish a mechanism for the selection of candidates, subject to the approval of the Director of the National Institutes of Health or the Administrator of the Alcohol, Drug Abuse, and Mental Health Administration, for the endowed scientific positions within the organizational structure of the intramural research programs of the National Institutes of Health and the Alcohol, Drug Abuse, and Mental Health Administration and candidates for participation in the National Institutes of Health Scholars program;

Government contracts.

"(10) enter into contracts with public and private organizations for the writing, editing, printing, and publishing of books and other material;

"(11) take such action as may be necessary to obtain patents and licenses for devices and procedures developed by the Foundation and its employees;

"(12) accept, hold, administer, invest, and spend any gift, devise, or bequest of real or personal property made to the Foundation;

"(13) enter into such other contracts, leases, cooperative agreements, and other transactions as the Executive Director considers appropriate to conduct the activities of the Foundation; Government contracts.

"(14) appoint other groups of advisors as may be determined necessary from time to time to carry out the functions of the Foundation; and

"(15) exercise other powers as set forth in this section, and such other incidental powers as are necessary to carry out its powers, duties, and functions in accordance with this subtitle.

"(h) ADMINISTRATIVE CONTROL.—No participant in the program established under this part shall exercise any administrative control over any Federal employee.

"(i) FUNDING.—

"(1) AUTHORIZATION OF APPROPRIATIONS.—Subject to paragraph (2), for the purpose of carrying out this part, there are authorized to be appropriated such sums as may be necessary for each of the fiscal years 1991 through 1995.

"(2) LIMITATIONS.—

"(A) Amounts appropriated under paragraph (1) or made available under subparagraph (C) may not be provided to the fund established under subsection (b)(1)(A).

"(B) For the first fiscal year for which amounts are appropriated under paragraph (1), $200,000 is authorized to be appropriated.

"(C) With respect to the first fiscal year for which amounts are appropriated under paragraph (1), the Secretary may, from amounts appropriated for such fiscal year for the programs of the Department of Health and Human Services, make available not more than $200,000 for carrying out this part, subject to subparagraph (A).".

SEC. 3. ESTABLISHMENT OF NATIONAL CENTER FOR MEDICAL REHABILITATION RESEARCH.

(a) IN GENERAL.—Subpart 7 of part C of title IV of the Public Health Service Act (42 U.S.C. 285g et seq.) is amended by inserting after section 451 the following new section:

"NATIONAL CENTER FOR MEDICAL REHABILITATION RESEARCH

"SEC. 452. (a) There shall be in the Institute an agency to be known as the National Center for Medical Rehabilitation Research (hereafter in this section referred to as the 'Center'). The Director of the Institute shall appoint a qualified individual to serve as Director of the Center. The Director of the Center shall report directly to the Director of the Institute. 42 USC 285g–4.

"(b) The general purpose of the Center is the conduct and support of research and research training (including research on the development of orthotic and prosthetic devices), the dissemination of health information, and other programs with respect to the rehabilitation of individuals with physical disabilities resulting from

diseases or disorders of the neurological, musculoskeletal, cardiovascular, pulmonary, or any other physiological system (hereafter in this section referred to as 'medical rehabilitation').

"(c)(1) In carrying out the purpose described in subsection (b), the Director of the Center may—

"(A) provide for clinical trials regarding medical rehabilitation;

"(B) provide for research regarding model systems of medical rehabilitation;

"(C) coordinate the activities of the Center with similar activities of other agencies of the Federal Government, including the other agencies of the National Institutes of Health, and with similar activities of other public entities and of private entities;

"(D) support multidisciplinary medical rehabilitation research conducted or supported by more than one such agency;

"(E) in consultation with the advisory council for the Institute and with the approval of the Director of NIH—

"(i) establish technical and scientific peer review groups in addition to those appointed under section 402(b)(6); and

"(ii) appoint the members of peer review groups established under subparagraph (A); and

"(F) support medical rehabilitation research and training centers.

The Federal Advisory Committee Act shall not apply to the duration of a peer review group appointed under subparagraph (E).

Government contracts.

"(2) In carrying out this section, the Director of the Center may make grants and enter into cooperative agreements and contracts.

"(d)(1) In consultation with the Director of the Center, the coordinating committee established under subsection (e), and the advisory board established under subsection (f), the Director of the Institute shall develop a comprehensive plan for the conduct and support of medical rehabilitation research (hereafter in this section referred to as the 'Research Plan').

"(2) The Research Plan shall—

"(A) identify current medical rehabilitation research activities conducted or supported by the Federal Government, opportunities and needs for additional research, and priorities for such research; and

"(B) make recommendations for the coordination of such research conducted or supported by the National Institutes of Health and other agencies of the Federal Government.

"(3)(A) Not later than 18 months after the date of the enactment of the National Institutes of Health Revitalization Amendments of 1990, the Director of the Institute shall transmit the Research Plan to the Director of NIH, who shall submit the Plan to the President and the Congress.

"(B) Subparagraph (A) shall be carried out independently of the process of reporting that is required in sections 403 and 407.

"(4) The Director of the Institute shall periodically revise and update the Research Plan as appropriate, after consultation with the Director of the Center, the coordinating committee established under subsection (e), and the advisory board established under subsection (f). A description of any revisions in the Research Plan shall be contained in each report prepared under section 407 by the Director of the Institute.

"(e)(1) The Director of NIH shall establish a committee to be known as the Medical Rehabilitation Coordinating Committee (hereafter in this section referred to as the 'Coordinating Committee'). Establishment.

"(2) The Coordinating Committee shall make recommendations to the Director of the Institute and the Director of the Center with respect to the content of the Research Plan and with respect to the activities of the Center that are carried out in conjunction with other agencies of the National Institutes of Health and with other agencies of the Federal Government.

"(3) The Coordinating Committee shall be composed of the Director of the Center, the Director of the Institute, and the Directors of the National Institute on Aging, the National Institute of Arthritis and Musculoskeletal and Skin Diseases, the National Heart, Lung, and Blood Institute, the National Institute of Neurological Disorders and Stroke, and such other national research institutes and such representatives of other agencies of the Federal Government as the Director of NIH determines to be appropriate.

"(4) The Coordinating Committee shall be chaired by the Director of the Center.

"(f)(1) Not later than 90 days after the date of the enactment of the National Institutes of Health Revitalization Amendments of 1990, the Director of NIH shall establish a National Advisory Board on Medical Rehabilitation Research (hereafter in this section referred to as the 'Advisory Board'). Establishment.

"(2) The Advisory Board shall review and assess Federal research priorities, activities, and findings regarding medical rehabilitation research, and shall advise the Director of the Center and the Director of the Institute on the provisions of the Research Plan.

"(3)(A) The Director of NIH shall appoint to the Advisory Board 18 qualified representatives of the public who are not officers or employees of the Federal Government. Of such members, 12 shall be representatives of health and scientific disciplines with respect to medical rehabilitation and 6 shall be individuals representing the interests of individuals undergoing, or in need of, medical rehabilitation.

"(B) The following officials shall serve as ex officio members of the Advisory Board:

"(i) The Director of the Center.

"(ii) The Director of the Institute.

"(iii) The Director of the National Institute on Aging.

"(iv) The Director of the National Institute of Arthritis and Musculoskeletal and Skin Diseases.

"(v) The Director of the National Institute on Deafness and Other Communication Disorders.

"(vi) The Director of the National Heart, Lung, and Blood Institute.

"(vii) The Director of the National Institute of Neurological Disorders and Stroke.

"(viii) The Director of the National Institute on Disability and Rehabilitation Research.

"(ix) The Commissioner for Rehabilitation Services Administration.

"(x) The Assistant Secretary of Defense (Health Affairs).

"(xi) The Chief Medical Director of the Department of Veterans Affairs.

"(4) The members of the Advisory Board shall, from among the members appointed under paragraph (3)(A), designate an individual to serve as the chair of the Advisory Board.".

42 USC 285g-4 note.

(b) REQUIREMENT OF CERTAIN AGREEMENTS FOR PREVENTING DUPLICATIVE PROGRAMS OF MEDICAL REHABILITATION RESEARCH.—

(1) IN GENERAL.—The Secretary of Health and Human Services and the heads of other Federal agencies shall—

(A) jointly review the programs being carried out (or proposed to be carried out) by each such official with respect to medical rehabilitation research; and

(B) as appropriate, enter into agreements for preventing duplication among such programs.

(2) TIME FOR COMPLETION.—The agreements required in paragraph (1)(B) shall be made not later than one year after the date of the enactment of this Act.

(3) DEFINITION OF MEDICAL REHABILITATION.—For purposes of this subsection, the term "medical rehabilitation" means the rehabilitation of individuals with physical disabilities resulting from diseases or disorders of the neurological, musculoskeletal, cardiovascular, pulmonary, or any other physiological system.

Approved November 16, 1990.

LEGISLATIVE HISTORY—S. 2857 (H.R. 5661):

HOUSE REPORTS: No. 101-869 accompanying H.R. 5661 (Comm. on Energy and Commerce).
SENATE REPORTS: No. 101-459 (Comm. on Labor and Human Resources).
CONGRESSIONAL RECORD, Vol. 136 (1990):
Oct. 19, considered and passed Senate.
Oct. 26, considered and passed House, amended.
Oct. 27, Senate concurred in House amendments.

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[Billing Code 4140-01]

DEPARTMENT OF HEALTH AND HUMAN SERVICES
National Institutes of Health

Notice of Meeting

Notice is hereby given that the Working Group on Medical Rehabilitation Research Training, a group of consultants convened to advise the Advisory Committee to the Director, NIH, will meet in public session on February 4 and 5, 1991 on the NIH campus in Bethesda, Maryland, in Building 31, Conference Room 4. The meeting will begin at 9:00 a.m. and end at 5:00 p.m. on February 4, and begin at 8:30 a.m. and end at 12:15 p.m. on February 5.

The Working Group is being established in response to a recommendation by the Task Force on Medical Rehabilitation Research which met at Hunt Valley, Maryland, June 28 and 29, 1990. The Task Force was convened by the NIH to develop a comprehensive research plan for medical rehabilitation research. One of the panels of that Task Force, the Panel on Basic and Clinical Research Training, recommended that the NIH establish a subsequent working group to address how research training mechanisms would increase the number of active researchers in medical rehabilitation.

As part of its mandate, the Working Group will review and identify existing NIH training and research award mechanisms that would promote increasing opportunities for single-investigator and collaborative interdisciplinary studies in rehabilitation medicine; identify new research training programs and expand existing ones to increase the

number of new and established investigators entering the field of medical rehabilitation and increase the diversity of research specialties represented in the field; and develop incentives to attract senior investigators in rehabilitation-related disciplines to actively pursue research in medical rehabilitation.

Subsequent to its deliberations, the Working Group will prepare a report of its conclusions and recommendations.

Comments and questions related to the proposed meeting of the Working Group should be addressed to Ms. Mary Demory, National Institutes of Health, Science Policy Analysis and Development Branch, Shannon Building, Room 218, 9000 Rockville Pike, Bethesda, Maryland 20892, (301) 496-1454.

Dated:

William F. Raub, Ph.D.
Acting Director, NIH

WORKING GROUP MEETING
AND
PROPOSED REPORT DRAFTING SCHEDULE

Meeting of the Working Group on Medical Rehabilitation Research Training	February 4-5, 1991
Draft Report Completed by Science Writer	Week of Feb. 19
Draft Report Mailed by NIH to Working Group Members for Review and Comment	Week of Feb. 19
Review of Draft Report by Working Group	Feb. 25-March 8
Comments Due to Working Group Co-chairs and Science Writer	March 8
Second Draft of Report Completed by Science Writer	March 15
Final Report Mailed to Working Group for Approval	March 18
Working Group Approval of Report Received by the Co-chairs and Dr. Moskowitz	March 22
Report of the Working Group on Medical Rehabilitation Research Training Available for General Distribution	April 2, 1991

Report of the Advisory Committee
to the Director, National Institutes of Health

Review of the National Institutes of Health Research Training Programs

June 1, 1990
Bethesda, Maryland

Proceedings of the 61st Meeting
of the Advisory Committee to the Director,
National Institutes of Health

Review of the National Institutes of Health Research Training Programs

Prepared by the Office of Science Policy and Legislation

FOR ADMINISTRATIVE USE

U.S. Department of Health and Human Services

Public Health Service
National Institutes of Health

June 1, 1990

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Executive Summary

The Advisory Committee to the Director (ACD), National Institutes of Health (NIH), joined by representatives of the National Advisory Councils and Boards of the NIH Institutes, met on June 1 to consider the report and recommendations of the NIH Task Forces for the Review of the NIH Biomedical Research Training Programs and also to consider a new NIH effort to initiate a 5-year research strategy at NIH. During the opening remarks of the meeting, Advisory Committee members and Council representatives received a status report on activities undertaken and planned as a result of the 60th ACD meeting, held on January 26, 1990. The Acting Director, NIH, Dr. William Raub, reported on the status of efforts to ensure continued progress in the administration of medical rehabilitation research at NIH. The Deputy Director for Intramural Research, NIH, Dr. Joseph Rall, then reported on activities related to strengthening the scientific review procedures of the NIH intramural research program.

In keeping with the principal purpose of the meeting—consideration of the recommendations of the NIH Task Forces for the Review of the NIH Biomedical Research Training Programs—representatives from the National Academy of Sciences (NAS), the Association of American Medical Colleges (AAMC), and the Association of American Universities (AAU) spoke on the broad context of biomedical research training. Task force members then summarized the deliberations, conclusions, and recommendations of the task forces on Physician Scientist Training, Training in Clinical and Community-Based Study Designs and Methodology, and Predoctoral and Postdoctoral Training of Nonphysician Scientists. Following that, Dr. George Galasso, Acting Director for Extramural Affairs, NIH, reported on activities undertaken to implement task force recommendations. After the presentations, Committee members and Council representatives discussed the recommendations of the three task forces. Advisory Committee member Mr. Rodney Nichols introduced the deliberations emphasizing the need for evaluation of and greater accountability regarding goal setting for NIH training programs as a whole.

During their deliberations, Advisory Committee members and Council representatives agreed with most of the task forces' recommendations and suggested some refinements. Committee members urged judicious wording of the recommendations concerning a minimum of 2 years of training for professional doctorate appointees, modification of the payback requirement, and implementation of 3-year K-series awards to ensure flexibility. While Committee members also agreed on the recommendation to support training of M.D.'s in epidemiology, biostatistics, and related topics, they believed the recommendation required further internal attention regarding training of others. The Committee did not reach a consensus, however, on the recommendation for a two-tier cost of education allowance as a mechanism to limit tuition payments and encouraged NIH staff to continue

to work toward a fair and balanced mechanism for addressing this problem. Throughout their deliberations, Committee members demonstrated great concern about the negative impact the current fiscal climate was having on NIH training activities and on the biomedical research enterprise as a whole.

The second portion of the meeting focused on a new NIH effort to initiate a 5-year research strategy. The rationale, objectives, and plans for this initiative were presented by Dr. Raub and the Associate Director for Science Policy and Legislation, NIH, Dr. Jay Moskowitz. Council representatives and Committee members reacted favorably to the planned initiative and suggested that it should be promoted both to increase its visibility outside the health research field and to provide information to the general public, Congress, and the executive branch.

Opening Remarks

Dr. Raub reported on the status of activities related to physical medicine and rehabilitation research. The Panel on Physical Medicine and Rehabilitation Research, composed of a group of consultants to the ACD, met in November 1989 to assess the current administration of medical rehabilitation research at NIH and to develop recommendations for ensuring continued progress in this area. After reviewing the panel's report at its January 26 meeting, the ACD concluded that

- An immediate effort to create a Center for Rehabilitation Sciences at NIH, as recommended by some within the medical rehabilitation research community, is premature;
- Activities related to medical rehabilitation research at NIH should be strengthened and this research area needs to capitalize on the strength of the several relevant NIH components and their ongoing and planned programs; and
- The Office of the Director, NIH, should initially assume an active coordinating role in developing a comprehensive plan for this area of research and in creating a transgovernmental entity to coordinate medical rehabilitation research within the Federal sector.

As a result of the panel's report and the related ACD conclusions, a task force on medical rehabilitation research made up of 100 national experts in the field of medical rehabilitation has been established. The task force is organized into panels addressing five areas of science: neurophysiological dysfunction, musculoskeletal disorders, cancer rehabilitation, geriatrics, and developmental issues in rehabilitation. It also includes four cross-study panels addressing basic and clinical research training; biomechanics; ergonomics and engineering; information resources; and assessment, epidemiology, and biostatistics.

The task force has the mandate both to identify the current state of knowledge in the area, research program goals, and major scientific and clinical opportunities, and to develop recommendations, priorities, and strategies for pursuing program goals and opportunities within the various NIH components. In reporting to the Senate Appropriations Committee in February 1990, Dr. Raub indicated that the work of this group of outside experts will result in a major policy initiative to ensure the strengthening of medical rehabilitation research supported by NIH. After its 2-day meeting at the end of June 1990, the task force will prepare a report on its deliberations.

The Deputy Director for Intramural Research, NIH, reported on activities related to strengthening the scientific review procedures of the NIH intramural research program. Committees of scientists have reviewed intramural research at NIH since 1956. A report issued in December 1988 on an independent study by NAS and the Institute of Medicine expressed concerns about the accountability and independence of the scientific review procedures of this research program. The Panel on Strengthening the Scientific Review Procedures of the NIH Intramural Research Program, composed of a group of consultants to the ACD, met in September 1989 to examine all aspects of current intramural research at NIH and to develop recommendations for strengthening its review procedures. After reviewing the panel's report at their January 26 meeting, Advisory Committee members and Council representatives indicated their agreement with the panel's 16 recommendations. These recommendations focused on evaluation of the scientific and administrative performance of the scientific directors; nomination, terms of office, and feedback of scientific counselors; and review functions and processes.

A modified policy for the review of intramural research, to be issued soon, has adopted all of the panel's suggestions with the recommended ACD revisions. This policy will apply to all NIH Institutes, as well as to intramural research of the National Institute of Mental Health and the National Institute on Alcohol Abuse and Alcoholism, which takes place on the NIH campus and is integrated into the NIH intramural program.

Among the recommendations that have been incorporated into the modified policy is the extension of the terms of the scientific counselors from 4 to 5 years. This change will increase the counselors' familiarity with the operation of the intramural program and enhance the continuity of the review process. The chair of each Board of Scientific Counselors will nominate members to the Board in collaboration with the Scientific Director of the Institutes; currently, the Scientific Director has primary responsibility for these nominations. The Scientific Directors themselves and their ability to manage their respective intramural programs will also be reviewed every 4 years, as is not done presently. In addition, formal reporting procedures have been developed for Scientific Directors to use in responding to the questions and suggestions that the Board of Scientific Counselors makes during the review process, and each Institute's Advisory Council will receive copies of reports related to the review. The Deputy Director for Intramural Research will also develop and issue guidelines on the conduct of the scientific review process. These guidelines will be standards rather than rigid procedures in order to allow for differences among the Institutes.

Boards of Scientific Counselors will also be established at the clinical centers. This change, which was not specifically suggested by the panel or the ACD, will address a concern raised during an earlier review of the centers about the review of research conducted there.

Research Training Program

The Broad Context of Biomedical Research Training

Institute of Medicine Report on Manpower

Dr. Joe G. Baker
Office of Scientific and Engineering Personnel
National Academy of Sciences

Dr. Baker presented highlights of the NAS report on the training and supply of biomedical and behavioral research scientists. The report is the ninth in an NAS series on the National Research Service Award (NRSA) research training program. Unlike previous studies, this one did not examine dental or nursing research because of lack of resources. This study also differed from previous ones in that, in addition to examining the academic labor market, it focused on nonacademic sources of demand, such as private industry, foundations, hospitals, and government, which have grown rapidly as a result of the growth of the biotechnology industry and the large public and private expenditures on health-related research and development during the 1980's. The study had three objectives: to determine the extent of the need for biomedical and behavioral research personnel; to assess the current training for such personnel, primarily the NRSA program; and to make recommendations on how the program should be altered.

In summarizing study findings pertaining to the extent of need for biomedical and behavioral research personnel, Dr. Baker reported that, from 1974 to 1987, potential growth in the number of biomedical scientists steadily eroded, and the surpluses of scientists that existed during the 1970's disappeared. Potential growth is defined as the difference between attrition from science—because of retirement, death, or other reasons—and the number of new Ph.D.'s produced. Since actual growth, defined as labor market demand, was greater than potential growth in the biomedical sciences, the field had to recruit scientists from other areas. Growth in the number of new behavioral scientists has also been very slow, and as the pool of currently active scientists has aged, attrition through retirement and death has risen sharply. Consequently, labor surpluses have also declined in the behavioral sciences. However, actual growth in this area has been consistently below potential growth.

New positions to be filled by biomedical and behavioral scientists will come from two sources: loss of scientists because of death, retirement, and movement to other occupations; and growth in total employment demand. The study projected that the number of new positions for biomedical scientists during the first half of the 1990's will be considerably greater than the number of new Ph.D.'s. For behavioral scientists, the projected picture is

somewhat different; that is, a small surplus of Ph.D.'s relative to the number of openings. However, nonclinical psychologists have been moving into clinical psychology, an area of high growth rates in employment and personnel shortages. If this trend continues, a shortage in research psychologists may begin to occur. In addition, although data on physician scientists were unavailable, the study committee felt that demand for physician scientists will increase with higher spending for health-related research and development, and it had anecdotal evidence that recruitment difficulties already exist in this area.

To rectify the imbalance between supply and demand for biomedical scientists, approaches to reducing the number of openings include raising salaries to prevent movement out of science into other occupations and making institutional changes to retain women, who have a higher rate of attrition than men in the work force. Strategies to increase the number of Ph.D.'s include reducing the time necessary to get a degree, attracting foreign students, and reducing the attrition rate of students in graduate school. Dr. Baker noted that 60 percent of the students who enter graduate school do not complete their studies.

The study committee's assessment of current training programs relied primarily on 16 previous studies of the NRSA training system, none of which was rigorously controlled. All these studies indicated that NRSA trainees perform better than scientists who were not NRSA trainees with respect to outcomes such as number of articles published, receipt of postdoctoral fellowships, graduation rate, and time to obtain a degree. Whereas it is not possible to ascertain whether these outcomes are related to the training itself or to the trainee selection process, Dr. Baker believed the results of the studies suggest that the training programs were selecting the best students as NRSA trainees.

Based on their finding of a current labor shortage in the biomedical sciences and the projection that this situation will be exacerbated in the future, the study committee recommended increasing predoctoral support in the Ph.D. biomedical training programs. Although the labor market and employment needs in the behavioral sciences were projected to retain the balance that currently exists, the committee recommended maintaining training in the behavioral sciences at current levels because of its strong belief in the growing importance of such behavior-related health problems as cancer, AIDS, and alcohol and other drug addictions. The committee also recommended maintaining training for physician scientists at current levels, but it suggested more rigorously evaluating the success of such training programs. Studies of student recruitment and retention, controlled studies of former trainees, and studies of women and minorities, as well as specific improvements in data sets and information, were also recommended.

Discussion

During their discussion of the NAS study report, Committee members and Council representatives requested and considered further information about several factors that may influence the supply of scientists. One issue raised was the impact that the change in the mandatory retirement law might have on supply. Dr. Baker indicated that while this change had not been considered in the development of study projections, other analyses have found a large one-time effect on retirement rates, after which the impact of the change was fairly low. Further, even if this change increases the retention of scientists, it would not be likely to influence the supply significantly. A related issue raised was the impact of retirement in the 1990's and into the 21st century of the "bulge" of scientists hired in the 1960's. The NAS study found that, compared with an annual loss of 700 scientists in the 1970's and just over 1,000 scientists in the 1980's, 1,600 retirements are projected annually for the 1990's. Given that the number of new biomedical science Ph.D.'s is 4,000 annually,

this projection means that after the openings created by retirement are filled, only 2,400 new scientists will be available for growth or to replace scientists who change occupations.

However, Dr. Baker did not see demographic factors such as the baby boom as having a major influence on the number of persons who enter science since only a very small portion of the population enter graduate school. Instead, interest in science is more likely to influence people to enter graduate school. Nonetheless, the baby boom will have an effect on the demand for faculty in the late 1990's when the baby boomers' children will be entering universities at the same time that the faculty who taught the baby boomers will be retiring.

Funding issues affecting the supply of scientists were also considered during the discussion. The Director of the National Institute on Aging noted that there are more training applicants than there are funds available for training, and Council representatives and Committee members suggested that potential students may perceive the greatly reduced funding rate for R01 grants as a sign of a lack of career opportunities. In the United Kingdom, for example, a 90-percent drop in applications for graduate positions was directly related to the lack of job opportunities. The negative impact of the current funding climate in the United States on young investigators was also noted, and it was suggested that any study of training needs must consider actual job opportunities. In response to these concerns, Dr. Baker agreed that the current funding climate was particularly difficult for young investigators, but he also noted that when the total amount of funds available and the total number of scientist years of effort produced are examined, there is still growth in these areas. Dr. Raub also pointed out that the current NAS report had a mandated focus on training programs and that NAS is now in the early stages of a study of young investigators that will examine some of these funding issues.

Funding issues also emerged in a discussion of attrition from graduate programs and from science. In agreeing with a Council member's suggestion that lack of financial support could be responsible for the high rate of attrition from graduate school, Dr. Baker noted that more financial support could not only assist in retaining students who are already in school but could also encourage them to enter training. More information about the difference in attrition from science between men and women was also requested. The NAS study found that for men and women who had their degree 10 years or longer, approximately 95 percent of the men versus 82 percent of the women were still involved in science full time. Dr. Baker noted that the supply situation could be improved if a greater percentage of women were retained.

The projected lack of growth in Ph.D.'s entering the academic sector was another subject of concern during the discussion. A Committee member noted that the moderate growth expected in the academic sector will inhibit the enrichment necessary in science and may mean that in 10 years NIH will not be able to purchase the same amount of research from the academic sector that it can purchase now. Dr. Baker agreed and suggested that because of this possibility, the risks related to producing too few scientists are greater than the risks attached to producing too many.

Discussion also focused on issues related to evaluating the success of training programs. Clarification about criteria used and comparisons made to measure success were requested. Dr. Baker noted that while a few studies have used matched comparison groups to evaluate training, comparison or control groups are the Achilles' heel of this area of evaluation. He also argued that a major impact of the NRSA training system may not be on the individual students who receive NRSA funding, but rather on the department that receives the funding and on other students there. Better faculty and better students not on training grants can be attracted by such departments, and intellectual vitality in the

classroom can be improved. Further, if some students are given NRSA support, other students can move into teaching or research assistantships. Consequently, all students in an NRSA-funded department may benefit, not just the top ones who receive NRSA support. These impacts may be difficult to evaluate. The definition of the training program for biomedical scientists was also discussed. A Council member suggested that, at least in the academic setting, the early career years should be considered as part of the training period.

Study of M.D./Ph.D. Training

Dr. Paul Jolly
Associate Vice President for Operational Studies
Association of American Medical Colleges

Dr. Jolly presented preliminary findings of a study on M.D./Ph.D. training being conducted by AAMC. The study is examining both NIH and non-NIH supported training to ascertain the number of M.D./Ph.D. students who enter training, the number of students who complete training and obtain both the M.D. and Ph.D., their characteristics, and the manner in which they differ from those students not involved in M.D./Ph.D. training.

In describing the study, Dr. Jolly emphasized current limitations of available data. The research is using data in an AAMC data base that tracks medical students through the residency. All students who apply to a medical school through the AAMC centralized application service are included in the data base. The association also administers questionnaires to all graduating seniors of medical schools; this questionnaire, for which there is a 70-percent return rate, asks whether students are in a Ph.D. program. Because non-AAMC schools also report on applicants to the AAMC, students who apply only to non-AAMC schools are also included in the data base. However, data on this group are less complete. Consequently, some of the students in this group who enter medical school with a Ph.D. may not be distinguished from those who complete the Ph.D. while in medical school. Further, complete data may not be available for students who enroll in medical school with the Ph.D. with advanced standing and therefore do not apply through the centralized application system. The association is now attempting to remedy these data limitations by requesting that individual M.D./Ph.D. program coordinators verify students involved in their programs.

Results of the preliminary analysis of data from 1980 to 1990 indicate that the number of minorities considered by the AAMC as underrepresented in medicine—that is, blacks, Mexican-Americans, mainland Puerto Ricans, and American Indians—who are in M.D./Ph.D. programs has remained very small while the percentage of Asians is increasing. M.D./Ph.D. students are more likely to marry by the time they graduate than are medical students in general, possibly because of the greater length of time involved in an M.D./Ph.D. program. Other preliminary results not only confirmed a high level of involvement of M.D./Ph.D. students in research-related activities both while in medical school and in their plans for future careers, but also suggested that a more than negligible number of medical students had been or were planning to be involved in such activities. Most M.D./Ph.D. students reported that they participated in a research project during medical school. Although the percentage of students in general involved in such a project was considerably less, this percentage has increased steadily over the study period. Most M.D./Ph.D. students also reported they had authored or coauthored a research paper while in medical school; approximately 25 percent of all medical students had done so. The great majority of M.D./Ph.D students planned to take a research fellowship after graduation from medical school; the percentage of all medical students reporting such plans ranged from 20 to 25 percent over the study period. Most M.D./Ph.D. students also reported that they planned to spend 25 percent or more of their time in research after they completed training;

fewer than 20 percent of all students indicated that they planned this level of research activity.

Discussion

During the discussion of the AAMC study on M.D./Ph.D. training, a Committee member requested clarification about the sources of funding of the M.D./Ph.D. students tracked by the AAMC. In response, Dr. Jolly noted that the AAMC was currently working with the National Institute of General Medical Sciences (NIGMS), which provides support for M.D./Ph.D. training, to determine the proportion of students supported by NIH and the proportion supported by other funding sources. Informal surveys of M.D./Ph.D. program directors have indicated that at some schools that receive NIH funding for M.D./Ph.D. training, there are some M.D./Ph.D. candidates who do not receive NIH support. There are also institutions that have M.D./Ph.D. programs but receive no NIH support at all.

In relation to this issue, Dr. Kirschstein, the Director of NIGMS, reported that the Institute supports 129 M.D./Ph.D. programs in 29 medical schools around the country. Although in some of these schools NIH funds are available for only half the students that the institution wishes to enroll in M.D./Ph.D. training, this funding enables the institution to put into place a curriculum and training process upon which it can build. While for many years approximately 630 students received funding annually, considerable pressure to increase that number has led to 735 students now being funded across all years of training. The training program takes about 6 1/2 to 7 years to complete; students receive support for a maximum of 6 years.

The patterns and outcomes of training for M.D./Ph.D.'s were another focus of the discussion. Dr. Kirschstein summarized data on long-term outcomes of a small cohort of Medical Scientist Training Program (MSTP) participants; these data indicated that 88 percent of the participants were in academic medicine and had grant approval and award rates believed to be significantly better than those of all NIH R01 applicants. One Committee member emphasized that the real assay point for the AAMC study must occur 3 to 8 years after graduation, when the career commitments of trainees can be more accurately evaluated. Another suggested that the outcomes of individuals who complete the M.D. and then participate in short-term research training should also be tracked and compared with the outcomes of those who receive M.D./Ph.D.'s. Dr. Jolly indicated that to evaluate long-term outcomes of M.D./Ph.D. training, faculty rosters of all medical schools will be scanned to ascertain the number of those faculty members who received M.D./Ph.D. training. Literature data bases such as Medline could also be examined to document the publication rates of those who received such training. Similar outcomes will be examined for the Medical Scholars Program and the Cloisters Program; for the most part, individuals in these research training programs do not receive Ph.D.'s. There are also plans to determine whether the M.D. and Ph.D. degrees were received simultaneously by those in the study sample and, if not, the order in which they *were* received. Relationships of these patterns of training to outcomes will be examined as well.

During the discussion, Dr. Kirschstein responded to an Advisory Committee member's question about the distribution of specialty interests of M.D./Ph.D. students. She noted that for the NIH MSTP program, the vast majority of graduates are in departments of internal medicine. The remainder are spread out over a variety of specialties, with the next greatest number in pediatrics. Most of these graduates go on to do house officer training and plan to take specialty boards, either in internal medicine or in subspecialties. Recently, a number of students wishing to conduct research during this latter stage of training selected pathology as a way to combine research with the demands of internal medicine.

Report of the Association of American Universities, "The Ph.D. Shortage: The Federal Role"

Dr. Robert Rosenzweig
President
Association of American Universities

Dr. Rosenzweig shared his observations on the AAU's report, "The Ph.D. Shortage: The Federal Role," and related issues. He noted that the report is based on a number of independent analyses that have reached similar conclusions—namely, that there will be substantial shortages of Ph.D.'s across all disciplines and in all employment markets in the latter part of this decade and into the next century. Underlying these shortages is an increase in industrial demand for scientists and engineers and an increase in academic enrollment.

Although the number of Ph.D.'s awarded in this country has remained fairly stable since the mid-1970's, the proportion of U.S. citizens earning doctorates declined for two decades until 1988, when a slight increase occurred. From one perspective, this is a positive situation since some of those from outside the United States whose primary, secondary, and collegiate education was paid for by non-U.S. sources have entered the U.S. labor market, at least temporarily. However, the AAU believes this to be an unstable base on which to build a national science policy. As regimes around the world become more liberal and economic growth is stimulated in parts of the world now supplying this country with graduate students, these students may find the possibility of returning to their homelands to apply their education more attractive and they will be more likely to do so. Thus, the AAU believes it desirable to increase the number of American nationals who enter Ph.D. programs and then the labor market.

Dr. Rosenzweig noted a correlation between the decline in the number of U.S. citizens earning Ph.D.'s and the decline in Federal support of Ph.D.-level education. From 1969 to the present, the number of federally funded fellowships and traineeships fell from approximately 60,000 to fewer than 13,000. While the NIH NRSA program is the largest for the funding of training and supports almost half of those 13,000 students, NRSA stipends are among the lowest of all Federal programs.

To address the projected shortages, the AAU has initiated a program of advocacy to increase Federal support for Ph.D. education. This program calls for doubling the number of fellowships and traineeships. However, this increase should not result in the training of too large a cohort, as occurred in the 1960's and 1970's, since doubling the current number would bring the total up to approximately 26,000—far less than the 60,000 fellowships and traineeships that were being awarded at the peak during the 1960's. This program has also requested an increase in research assistantships, new strategies to increase participation by non-Asian minorities and women, expanded and flexible support of research, and direct funding for research facilities and instrumentation. The association believes that this total package is necessary to attract new students to academic or scientific training and careers.

The second part of the AAU program grows out of the recognition that institutions, rather than the Federal Government, have the primary responsibility for addressing the projected shortages. They can meet this responsibility by dealing more effectively with student attrition from graduate programs and by reducing the time necessary to complete a degree, which has continued to grow in all fields. While lack of stipends may have some impact on length of time in training, Dr. Rosenzweig argued that the relationship between the student and his or her thesis adviser is the most important determining factor and that this relationship has deteriorated over the years. A common understanding of the requirements for a Ph.D. dissertation, if it ever existed, has also been lost as some schools now

require dissertations to be completed pieces of scholarship—that is, a publishable book or an already published article—rather than evidence of the ability to conduct independent research.

While the response of the academic community to the AAU's public policy recommendations has been mainly positive, there is some resistance to the current perception that the country is now too poor to pay for the necessities of life, much less to make the investments required to provide for their enhancement in future decades. This perception of limited resources has led to concern that money spent on training means less spent on research. However, it is Dr. Rosenzweig's belief that universities are not research "job shops" but rather educational institutions with a responsibility for educating and training students that is at least as important as their obligation to provide new knowledge. Further, universities should reach for available resources and take advantage of a climate receptive to increased funding for training. He also noted that while there is concern about overproduction of Ph.D.'s as occurred 20 years ago, there is at present no unemployment among Ph.D.'s.

Discussion

The question of non-U.S. citizens entering training in various disciplines was one focus of discussion about the AAU report. A Council representative took exception to the report's statement that "it is unwise national policy to rely so heavily on imported talent and to fail to develop our own intellectual resources," noting that the United States has historically depended on influxes of people from other countries. In addition, he questioned whether this pattern of events is properly termed "national policy."

In response, Dr. Rosenzweig argued that while there is no national policy on this matter, policy can be inferred from behavior. Further, while he acknowledged that this country's great source of strength has been its ability to attract and absorb immigrants who have contributed enormously to scholarship and to life in general, individuals who come to this country for training are not immigrants in the classic sense. For the most part, they do not come here to become American citizens but rather to go to school, and it is risky, therefore, to base national policy on the assumption that these individuals will behave like previous groups of immigrants. He agreed, however, with the Council representative's point that the validity of this assumption is still unknown and may prove to be correct.

Financial support of biomedical research training and institutions was another focus of discussion. A Council representative noted that while the AAU report examined support of graduate students across all disciplines, funding in the biomedical fields differs from that in other academic fields. Dr. Rosenzweig agreed noting that the proportion of Federal funds supporting training is greater in biomedical fields than in any other field. Institutional funds supporting training in this area are also often indirectly derived from Federal support.

Report on the Review of the NIH Biomedical Research Training Programs

Physician Scientist Training

Dr. Jay Moskowitz
Associate Director for Science Policy and Legislation
National Institutes of Health

After reviewing the history of NIH research training programs, which began with the legislation that formally established the then National Institute of Health in 1930,

Dr. Moskowitz noted that the fundamental goal of these programs is to prepare well-trained, highly qualified, and productive research investigators in fields relevant to the advance of biomedical science. The NRSA program, established in 1974, is currently the only authority under which NIH supports training of persons for careers in biomedical sciences. The charge to the Task Force on Physician Scientist Training, and to the other task forces as well, was to identify and assess issues related to the development of physician scientists and to make recommendations for improvements.

After examining the early recruitment of talented individuals into research careers, the task force found that inadequate numbers of individuals with professional doctorates—that is, M.D.'s or other professional doctorates—are entering biomedical research careers. Studies of short-term training for health professional students—for example, the NIH T-35 program—indicated that these programs are effective in stimulating interest in research careers. However, only one NIH Institute, the National Institute on Neurological Disorders and Stroke, supports short-term traineeships in its institutional NRSA training grants for professional predoctoral students. The task force believed that expanding opportunities for predoctoral research experiences as part of institutional training grant programs will enhance early recruitment efforts. Accordingly, it recommended that "professional predoctoral students should be eligible for training on institutional training grants during the summer or elective time for periods of between 3 and 12 months with a maximum of 12 months. A minimum of 6 months should be encouraged."

The task force also addressed the length of research training required to prepare professionally trained individuals for independent research careers. Application for and receipt of NIH research grant support is an important measure of an individual's level of research development. Data on M.D.'s who received postdoctoral research training for 12 months or less, for 12 to 24 months, and for more than 24 months documented a strong relationship between the duration of postdoctoral research training and the likelihood of applying for and being successful in receiving NIH independent research support. The task force concluded that 12 months of postdoctoral research training is inadequate to prepare most individuals for independent research careers and that training in most cases should extend for a period of up to 5 years. It was further believed that requiring a minimum of 2 years of research training will increase the likelihood that those individuals accepting appointments have a real interest in research careers. A modification of the payback requirement so that it is incurred in the first training year and satisfied by the completion of the second training year should provide trainees with incentive to complete the minimum appointment period.

The task force also decided that optional appointments for a third or fourth year of training under a T-32 NRSA training grant should be allowed. However, there was concern about the appropriateness of delegating to the training directors the decision to extend training beyond the first 2 years, and it was believed that third- and fourth-year appointments should require an NIH review. In other instances, trainees may be ready and would be encouraged to apply for support from competitive funding programs—for example, the F-32 NRSA individual fellowship grant, the FIRST (First Independent Research Support and Transition) Award, or an R01. The task force also concluded that a 3-year K-series career development award should be implemented; when coupled with the initial T-32 2-year training experience, it will provide professional doctorates with the total of 5 or more years of research experience deemed necessary to prepare them for a successful research career. It was also concluded that salaries for K-series awards should be higher than corresponding stipends for training grant appointments to provide incentive for trainees to seek independent support through national competition.

Based on these conclusions, the task force made the following recommendations:

- A minimum of 2 years of training should be required for all professional doctorate appointees to institutional NRSA grants. Trainees should be encouraged to apply for further research training and career development through national competition. Training grant appointments may be extended beyond 2 years upon the recommendation of the training director and with NIH concurrence.
- The NIH/Department of Health and Human Services (DHHS) should plan to modify the payback requirement of the NRSA reauthorization legislation.
- Three-year K-series awards should be made available for professional doctorates, and salaries should be increased to $50,000 per year.

The task force also recognized that any revision to the existing training structure would have to be compatible with the requirements for board certification. Based on information received from representatives of the scientific community familiar with clinical training requirements for board certification, the task force concluded that a revised research training structure can be effectively integrated with the requirements for clinical training, endorsed a flexible approach accommodating differing needs and preferences for clinical training, and recommended that "multiple pathways should be permitted to accommodate the needs for clinical certification within the context of the research training experience of 2 or more years."

Because available data demonstrate no relationship between training program size and subsequent development of trainees into independent investigators, the task force agreed that NIH should not arbitrarily limit the number of trainees permitted on a training grant and recommended that "numbers of trainees in training programs should be consistent with individual ICD (Institutes, Centers, and Divisions) policy and the institution's resources."

However, available data indicate that M.D.'s trained in programs that also train Ph.D.'s are more likely to apply for and receive independent NIH support than M.D.'s trained in programs with only other M.D.'s. The task force therefore recommended that "the presence of both M.D. and Ph.D. trainees in the same program should be considered favorably in the review of NRSA training grant applications."

Finally, the task force on physician scientist training recommended that

- Special training experiences away from the training institution may be proposed as part of a training grant application or subsequently to NIH staff; and
- Review of competing renewals for NRSA training grants should focus on trainee performance as it relates to preparation for a productive research career.

Training in Clinical and Community-Based Study Designs and Methodology

Dr. Curtis Meinert
Johns Hopkins School of Hygiene and Public Health

Dr. Meinert, a member of the National Advisory Eye Council and of the Task Force on Training in Clinical and Community-Based Study Designs and Methodology, discussed recommendations of that task force. It focused on the training of physician scientists as well as on undergraduate doctoral training to prepare scientists for leadership and support roles in clinical trials, epidemiological followup studies, and large-scale multicenter studies.

During its deliberations, the task force observed that there has been limited growth in the production of biostatisticians and epidemiologists: 44 persons received Ph.D.'s in biostatistics in 1979 and 47 in 1988. For epidemiologists, 76 received Ph.D.'s in 1983 and 99 in 1988. Further, the demand for personnel to become involved in clinical trials and epidemiological studies exceeds the supply of those with appropriate training, and existing degree programs are not prepared to meet the needs of physicians who want additional training. Consequently, such individuals generally enroll in schools of public health for 1-year Master of Public Health programs that provide broad but nonintensive training in epidemiology, biostatistics, and policy.

Graduate training in traditional departments of biostatistics and epidemiology does not really prepare students for community-based or multicenter research. While students of biostatistics are well trained in methods and procedures, they do not receive extensive training in the art and science of data collection per se. On the other hand, training of epidemiologists emphasizes data collection but is weak in methodology. Moreover, the training model for each of these disciplines does not prepare students for work in a collaborative setting.

The task force concluded that training programs are needed that focus on epidemiology, biostatistics, and related topics, including hands-on experience at various stages of ongoing clinical trials and epidemiologic research as well as didactic work. Such training should include master's programs, predoctoral programs leading to the Ph.D., and—primarily for physician scientists—nondegree certificate programs. In addition, courses and seminars relevant to participation in this type of research—for example, courses addressing data collection and data systems design, the ethics of design, meta-analysis, and the art and science of collaboration—do not exist and need to be developed.

In line with these conclusions, the task force recommended that "advanced programs of study and K-series awards should be supported in epidemiology, biostatistics, or related topics to increase predoctoral and postdoctoral research training opportunities. Current NIH mechanisms also should be used to support master's degree-level programs and nondegree certificate programs that focus on these topics."

Predoctoral and Postdoctoral Training of Nonphysician Scientists

Dr. Ruth Kirschstein
Director
National Institute of General Medical Sciences

Dr. Kirschstein summarized the recommendations of the Task Force on Predoctoral and Postdoctoral Training of Nonphysician Scientists. She noted that while there were considerable problems regarding the issues addressed by the other task forces, the training of nonphysician scientists had been relatively free of problems. Nonetheless, there were some issues that needed to be addressed.

First was the question of tuition for predoctoral students. Since the inception of the NIH research training programs, there has been a commitment to provide full tuition and related fees for predoctoral students. Since the passage of the National Research Service Award Act in 1974, however, limitations have been placed on the amount of fees to be paid above and beyond tuition. Further, in the past two decades, tuition charges for predoctoral students have risen at about 10 percent a year. This has led to sharp reductions in the number of predoctoral students supported. Consequently, several of the Institutes have had to freeze tuition costs to sustain their training programs. Another policy that was implemented to address this problem was the limiting of tuition increases to 6 percent in the

noncompeting years before renewal of training grants. While this policy produced some reductions, the new tuition levels set at the time of renewal made up for the difference.

Many of the other Federal agencies do not pay full tuition costs for the trainees and fellowships they support but rather provide a flat fee or a cost of education allowance. A committee of NIH staff presented a proposal to the task force recommending that NIH provide a cost of education allowance for each predoctoral trainee. However, because NIH has long been committed to paying full tuition, the task force felt that a sudden change from full payment could have a drastic impact. It therefore suggested a two-tier system, with one tier based on current charges for public institutions and the other for private institutions, as was previously proposed by the NIH Committee on Payment of Tuition for Research Training. The task force recommendation was that "the proposed two-tier cost of education allowance as a mechanism to limit tuition payments is reaffirmed. The same general principles should be applied to special NIH research training programs."

The training stipends paid by different Federal agencies vary considerably. Although the NIH predoctoral stipend has recently been raised to $8,500, it is the lowest among the Federal agencies. It was suggested that the NIH stipend be raised to $10,000 but only if new funds are available. It was also recognized that stipends for postdoctoral training should be equivalent to house staff salaries. The task force has proposed the same stipends for post-M.D.'s and post-Ph.D.'s. Accordingly, the task force recommended that "postdoctoral stipends for professional doctorates should be at least as attractive as current house staff salaries. Stipend levels should also be increased for academic trainees. Annual stipend increases are necessary to compensate for increased living costs."

With regard to training stipends, the task force also recommended that "Federal agencies supporting biomedical research training should explore ways of making the mechanism of support more equivalent."

The task force also believed that, to assess the success of past and current training endeavors appropriately and accurately, improved data collection procedures are required. It was therefore recommended that

- Standardized information necessary to assess program performance should be collected on all individuals and institutions receiving NRSA research training support; and
- Available NIH training data should be analyzed further and new data bases established as needed.

Finally, the task force believed that although funds are limited, possible new approaches to training should be examined. For example, individual predoctoral fellowships, which were funded by NIH before the National Research Service Award Act and which are being used effectively in other components of the Public Health Service, have the potential to complement existing NIH predoctoral training grants by expanding the number of institutions involved in training. Consequently, the task force recommended that

- The opportunity for individual predoctoral fellowships to address specific NIH training needs should be reviewed; and
- Needs in new research areas and approaches that enable NIH research training to respond to these needs should be evaluated on an ongoing basis.

Discussion

Council representatives varied in their beliefs about the appropriate minimum amount of time for a predoctoral research experience. A member of the Arthritis, Musculoskeletal, and Skin Diseases Council indicated that it was the consensus of that Council that the proposed maximum of a 12-month predoctoral training experience may be inadequate for some potentially excellent physician scientists and that an effort should be made to encourage a longer term minimum of, for example, 6 months and a maximum of 18 to 24 months. However, another member believed that while a 3-month commitment is appropriate for stimulating a level of interest in research that may ultimately lead to a research career, forcing a commitment of 6 months at the predoctoral level may reduce the probability of some students becoming involved in research training at that level.

Council representatives and Committee members emphasized the need for flexible approaches to providing Ph.D.-level training for professional doctorates. One issue raised was the impact 2 years of research training may have on clinical training. Concerns were also expressed by Council representatives about the recommended 2-year minimum appointment for postdoctoral training and the related payback requirement. If directors were required to make all appointments for 2 years, fewer individuals would be trained. It was noted that while most basic science departments generally do not accept trainees for less than 2 years, a person may be appointed to a T-32 training grant for 1 year and moved to another source of funding for the second year. It was suggested that additional options such as other Federal research awards or employment as Federal research scientists should be incorporated into the recommended payback modification to satisfy the second-year payback requirement. In response to this latter point, Dr. Moskowitz noted that while such possibilities were not included in the task force report, they were considered during deliberations and could be incorporated into the mechanism developed by the Office of Extramural Research to implement this recommendation.

The recommendation pertaining to tuition for predoctoral trainees stimulated considerable discussion by Committee members and Council representatives. It was noted that while other components of a university have various sources of support, costs in the medical centers cannot be easily shifted. Further, although there have been sharp increases in tuition over the last decade, these cover real costs. If a cap is placed on tuition, covering these charges will lead to a reduction in other institutional training efforts. A Committee member suggested that less rigid approaches should be considered—for example, linking tuition increases that are to be met by the Federal Government to other appropriate parameters such as undergraduate tuition.

In response, Dr. Kirschstein acknowledged that all the alternatives considered by the Task Force on Predoctoral and Postdoctoral Training of Nonphysician Scientists were found to have a negative aspect. Dr. Raub also noted that in discussions on this topic, stereotypic views tend to be presented. University presidents emphasize the need for full costs and are willing to enroll fewer students, while chairs of basic science departments argue that numbers of trainees are critical and that the institution will somehow cover the extra costs. The two-tier system recommended by the task force was believed to be a compromise that was at least more compatible with previous NIH policy than the contribution to the cost of education that other Federal agencies have adopted. However, it was also acknowledged that this approach was not likely to lead to an increase in the low number of trainees, which some Council representatives and Committee members viewed as a more serious problem than the tuition issue. Rather, the two-tier system will allow NIH training programs to be sustained. However, Dr. Raub noted that the recommended caps are parameter values that can be adjusted each year in keeping with the budget and that, therefore, this is a flexible approach.

The recommended increase in stipends was also a topic of discussion. Concern was expressed that while such an increase may be instituted to attract more students, the reverse may occur because the higher stipend amounts may require the total number of training slots to be decreased. A Council representative suggested that NIH determine a maximum stipend level but give training directors discretion in the amount provided to specific individuals since some trainees may enter the system with lower stipend levels and some support from another source. This approach would allow the program director to use funds to maximize the number of trainees. The possibility of having built-in inflationary costs in the training stipends, such as those included in the T, K, and R01 awards, was also raised. However, it was noted that while this approach has been previously proposed, necessary funds have not been appropriated.

Report of Activities to Implement Recommendations Contained in the Review

Dr. George Galasso
Acting Deputy Director for Extramural Affairs
National Institutes of Health

Dr. Galasso reported on the activities that had been undertaken to implement the recommendations contained in the Review of the NIH Biomedical Research Training Programs. In so doing, he summarized the comments of the National Advisory Councils and Boards pertaining to each of the recommendations:

- Professional predoctoral students should be eligible for training on institutional training grants during the summer or elective time for periods of between 3 and 12 months with a maximum of 12 months. A minimum of 6 months should be encouraged.

While the majority of Councils responding agreed with the recommendation about training for professional predoctoral students, the Board of the National Cancer Institute (NCI) cautioned that funds for this training could be misused to supplement undergraduate thesis funds and would also reduce funds available for traditional research training.

- A minimum of 2 years of training should be required for all professional doctorate appointees to institutional NRSA grants. Trainees should be encouraged to apply for further research training and career development through national competition. Training grant appointments may be extended beyond 2 years on the recommendation of the training director and with NIH concurrence.

- NIH/DHHS should plan to modify the payback requirement of the NRSA reauthorization legislation.

Most Councils responding also agreed with the recommended 2-year training minimum and modification of the payback requirement. Comments received related primarily to the payback requirement. It was suggested, as had also been noted earlier in the meeting, that payback through appropriate means other than a second year on an NRSA training grant should be possible. There was also concern that those who wanted or needed only 1 year of training would avoid such training if payback were required for less than 2 years of training.

Submission of a legislative proposal is necessary to modify the payback requirement. A proposal has been submitted, but no further action has occurred.

- Three-year K-series awards should be made available for professional doctorates. Salaries should be increased to $50,000 per year on these awards.

All responding Councils favored this. The 3-year award has been announced in the *NIH Guide*, and funds to cover the proposed increase in salaries have been requested.

- Multiple pathways should be permitted to accommodate the need for clinical certification within the context of the research training experience of 2 or more years.

Most of the responding Councils also favored this recommendation. Some concerns were raised, however, about the effect that 2 years of research training may have on the clinical training of those involved. The American Board of Internal Medicine has indicated that mechanisms exist to allow the incorporation of research training while ensuring proper clinical training. The American Board of Psychiatry and Neurology has also been approached to determine the flexibility in those specialties.

- The presence of both M.D. and Ph.D. trainees in the same program should be considered favorably in the review of NRSA training grant applications.

All responding Councils favored this recommendation. No further action other than encouragement by the ICD's of their grantees is needed to implement the recommendation.

- Special training experiences away from the training institution may be proposed as part of a training grant application or subsequently to NIH staff.

All responding Councils favored this recommendation. No further action other than encouragement by the ICD's of their grantees is needed to implement the recommendation.

- Review of competing renewals for NRSA training grants should focus on trainee performance as it relates to preparation for a productive research career.

All responding Councils supported this recommendation. An NIH-wide work group has been established to develop procedures for grant applicants to use to document the career patterns of former trainees in their applications.

- Advanced programs of study and K-series awards should be supported in epidemiology, biostatistics, or related topics to increase predoctoral and postdoctoral research training opportunities. Current NIH mechanisms should also be used to support master's degree programs and nondegree certificate programs that focus on these topics.

All responding Councils supported this recommendation. A legislative proposal would be needed to initiate support of master's degree and certification programs. Proactive efforts are also needed to encourage training in these areas.

- The proposed two-tier cost of education allowance as a mechanism to limit tuition payments is reaffirmed. The same general principles should be applied to special NIH research training programs.

Most of the responding Councils were in favor of this proposal. However, the NCI Board expressed concern about underfunding the full costs of research training and believed this approach might be inappropriate. No further action has been taken on this recommendation.

- Postdoctoral stipends for professional doctorates should be at least as attractive as current house staff salaries. Stipend levels should also be increased for academic

trainees. Annual stipend increases are necessary to compensate for changes in living costs.

All responding Councils favored the recommendation to increase stipends, and four of those responding also suggested that the stipends should be increased even if it results in the training of fewer individuals.

- Standardized information necessary to assess program performance should be collected on all individuals and institutions receiving NRSA research training support.
- Available NIH training data should be analyzed further and new data bases established as needed.

All responding Councils agreed with the recommendations for improved data collection efforts. The NIH Training Activities Committee is developing a standardized reporting mechanism for capturing information to develop needed data bases.

Discussion

Following the presentations and related discussion, the final deliberations of Committee members and Council representatives on the review of the NIH biomedical research training programs took place. These deliberations began with some observations by Advisory Committee member Mr. Rodney Nichols, Executive Vice President of Rockefeller University, on the NIH training program review and related topics considered at the meeting.

As an introduction to his observations, Mr. Nichols expressed appreciation for the efforts involved in the review of the NIH biomedical research training programs, which he believed documented the seriousness with which NIH is taking the current national problems related to training. However, he noted that, as indicated in the NAS study report, essential baseline data are lacking and more funds should be spent on gathering this information. If such data had been available for the past 25 years, planning for the future might be easier. He also noted that the Federal view should be compared with the rather different perspective of major research centers, such as Rockefeller University, which, he believed, would be willing to participate in an evaluation effort by providing advice and the results of their own data collection efforts. In addition, measures of success in training need to be clarified, an issue that was not addressed in the review of NIH training programs. Publications in refereed journals and receipt of R01 grants are two frequently mentioned indices. If these are considered to be the primary measures of success, this fact should be stated, and data on these measures should be systematically gathered. Similarly, if other measures are believed to document success, this should be explained as well and relevant data collected.

Consideration of Individual Task Force Recommendations

The Committee then turned to consider the individual recommendations made by each task force to determine which recommendations achieved a general consensus and to further consider issues related to particular recommendations.

- Professional predoctoral students should be eligible for training on institutional training grants during the summer or elective time for periods of between 3 and 12 months with a maximum of 12 months. A minimum of 6 months should be encouraged.

There was a general consensus in favor of this recommendation. Discussion focused primarily on the calculation of the time period for training. While there was agreement that the recommended 6-month training period could be split into two 3-month periods, a training period based on the totaling of evening, weekend, and other odd hours was viewed as logistically impossible to track. Further, except in special circumstances, it was believed a student working in an active laboratory at odd hours would find it difficult to sustain a true research project.

- A minimum of 2 years of training should be required for all professional doctorate appointees to institutional NRSA grants. Trainees should be encouraged to apply for further research training and career development through national competition. Training grant appointments may be extended beyond 2 years on the recommendation of the training director and with NIH concurrence.

There was general agreement with the requirement of 2 years' minimum training for all professional doctorate appointees to institutional NRSA grants. The discussion of the recommendation focused primarily on the language used. There was concern that the recommendation not be written to imply that only 2-year appointments could be made to training grants. It was suggested that the recommendation be worded to convey that the grant could be used only as part of a training program of 2 years or longer. There was also agreement on language that would encourage 2-year appointments to training programs as a matter of administrative practice.

- NIH/DHHS should plan to modify the payback requirement of the NRSA reauthorization legislation.

There was general agreement with the recommendation that the payback requirement of the NRSA reauthorization legislation be modified from its current status in which the first year of training does not incur a payback. The modified requirement would hold that if an individual trains for 2 or more years, no payback will be necessary. Dr. Raub indicated that the legislative proposal could be written to include other legitimate research experience during the second year as meeting the payback requirement.

In response to a Council representative's request for information about enforcement of the payback requirement over the years, Dr. Raub indicated that an elaborate recording system has been established that provides considerable incentive for individuals to report their status and its relationship to the requirement. The vast majority of training recipients have had no difficulty in meeting the requirement, and although some have been required to pay back the money received, their number is very small. Although Dr. Raub noted that the administrative burden involved in this tracking process is significant, he also acknowledged that the motivation underlying the recommendation was to encourage people to enter research careers and not to reduce this burden.

Council representatives and Committee members further requested information about the approach to be used in justifying the proposal and the scope of the proposal's impact. Dr. Raub stated his belief that NIH can demonstrate that it has taken the current payback requirement seriously and that the principal reason for its implementation—to discourage the support of clinical experiences under the guise of research—has not been a problem for a long time. Dr. Kirschstein also noted that there was little difficulty in receiving approval for an earlier proposal to change the requirement to allow 12 months of research training without payback; this fact suggests that the current recommendation may be successful as well. Dr. Moskowitz indicated that the modification is being recommended only for M.D.'s and that it would require concurrence by all agencies with NRSA authority, including any relevant agency of the Public Health Service.

- Three-year K-series awards should be made available for professional doctorates. Salaries should be increased to $50,000 per year on these awards.

While no disagreement was expressed with this recommendation, various aspects of the proposal and its implications led to discussion and suggestions for refinements by Council representatives and Committee members. In response to a Council member's suggestion that the recommended salary increase occur only if funds are available, Dr. Raub noted that K-series funds come from the research grant pool and that a salary increase would therefore involve a tradeoff. Another suggestion was that the status of career development awards be changed so that their funds no longer come from the research grant pool. In response, Dr. Raub, while noting that such reevaluation of the award's status was possible, indicated that caution would be required because of the strong NIH tradition of recognizing training as a distinct activity. Dr. Kirschstein also expressed reservations about such a modification because the NRSA authorization has a ceiling on funding. Other Council representatives expressed concerns about salary figures included in the recommendation, noting that the inclusion of a specific salary figure may ultimately become a frozen benchmark and that the requested salary increase from $40,000 (which has been in place for over 10 years) to $50,000 does not keep up with inflation.

Based on the concern that the 3-year designation in the recommendation is unnecessarily limiting, it was proposed that more flexible language be used to describe the training period. Dr. Moskowitz suggested that the phrase "3, 4, or 5 years," which was in fact the intent of the task force, be adopted. Differences in types of K awards and the association of these differences with varying time requirements was also noted. For example, a K04 award—that is, a research development award—has traditionally been a 5-year award targeted at the trained investigator who is usually simultaneously applying for an R01 award, and the desire to reduce its length is not likely. It is also not clear whether it would be appropriate to reduce the 5-year length of the physician scientist award, which involves training in basic research laboratories followed by supervision by a monitor. The recommendation is most relevant to the clinical investigator award, and it was suggested that the language of the recommendation reflect this fact.

- Multiple pathways should be permitted to accommodate the needs for clinical certification within the context of the research training experience of 2 or more years.

There was general agreement with this recommendation. The brief discussion emphasized that the task force intended to promote flexibility wherever possible and that concurrence with the recommendation did not imply support of any specific scheme that may have been used as an example in the task force report or presentation.

- The presence of both M.D. and Ph.D. trainees in the same program should be considered favorably in the review of NRSA training grant applications.

No disagreement was expressed with this recommendation. Dr. Raub indicated that this point has never been made explicit, and there was a sense that it would be helpful to emphasize it. He also noted that some training grants have included only physicians and that some of these grants have had disappointing yields.

- Special training experiences away from the training institution may be proposed as part of a training grant application or subsequently to NIH staff.

No disagreement was expressed and no discussion was initiated on this recommendation.

- Review of competing renewals for NRSA training grants should focus on trainee performance as it relates to preparation for a productive research career.

There was general agreement with this recommendation. A Council representative emphasized that this approach should not prejudice the consideration of promising new training grant proposals.

- Advanced programs of study and K-series awards should be supported in epidemiology, biostatistics, or related topics to increase predoctoral and postdoctoral research training opportunities. Current NIH mechanisms also should be used to support master's degree programs and nondegree certificate programs that focus on these topics.

While Committee members and Council representatives agreed that M.D.'s should be supported for training in the areas of epidemiology, biostatistics, and related topics, they demonstrated a concern that directing training funds at nonprofessional degree-seeking students may not be desirable. Although the need for individuals to staff clinical trials was acknowledged, it was argued that funding the training of such individuals did not appear to be compatible with the NIH mission. It was concluded that although the Committee favored the recommendation as it relates to M.D.'s, the recommendation required further internal attention with respect to its relevance to the training of other persons.

- The proposed two-tier cost of education allowance as a mechanism to limit tuition payments is reaffirmed. The same general principles should be applied to special NIH research training programs.

Discussion focused on the perception of an NIH shift from the use of an investment strategy in its funding approach—that is, investment in people and institutions—to an approach driven by exigency. Related to this was the belief that the identification and funding of the minimum number of trainees necessary to sustain the research enterprise was of paramount importance yet had not been identified in any of the task force recommendations. In response, Dr. Raub indicated that the importance NIH places on maintaining a sufficient number of trainees has led to the need to place greater restraints on stipend levels and tuition reimbursements. This policy is also implicit in the President's budget for fiscal year 1991, which proposes 12,000 trainees along with a continued restraint on stipend level and the two-tier tuition cap.

The Committee did not reach a consensus on the tuition issue, and it encouraged NIH staff to continue to work toward a fair and balanced mechanism for addressing this problem.

- Postdoctoral stipends for professional doctorates should be at least as attractive as current house staff salaries. Stipend levels should also be increased for academic trainees. Annual stipend increases are necessary to compensate for changes in living costs.

While no disagreement was expressed with this recommendation, Council representatives and Committee members emphasized that the recommended increase for predoctoral stipends should occur only if new funds are available. The primary focus of discussion was on the possibility that the prohibition against supplementing stipends with Federal funds could be lifted. Council representatives and Committee members saw this proposal as a means to address large salary discrepancies and thereby to increase the probability of attracting M.D.'s into a research training program.

Dr. Raub reviewed two aspects of the rationale for the prohibition. First, training and research are authorized separately by Congress, and by regulation, DHHS has endeavored

to ensure that these two discrete authorizations are not intertwined in any way that would be seen as contrary to the intent of Congress. Some also feared that the concept of stipends would be eroded if such supplementation could occur, and that this could lead to a reduced commitment to stipends and to greater movement toward apprenticeship models, which have been used by other research agencies as well as by NIH. However, Dr. Raub believed that reopening the question would be appropriate, and it was concluded that, on the Committee's recommendation, NIH staff should assess the feasibility and desirability of a change in the prohibition.

- Standardized information necessary to assess program performance should be collected on all individuals and institutions receiving NRSA research training support.
- Available NIH training data should be analyzed further and new data bases established as needed.

Although no disagreement was expressed with these recommendations, some issues were raised by Council representatives. The representative from the National Advisory Environmental Health Council noted that a substantial proportion of the trainees of the National Institute of Environmental Sciences are employed in industry as toxicologists and pathologists; the representative indicated that appropriate measures are needed to evaluate the contribution of this training, which may not be measurable using R01s or publications. The representative was assured that this need was well understood by the task force responsible for the recommendation. In response to concern expressed about the source of funds that would be used to enhance the data collection process, Dr. Raub acknowledged that funds would have to come from the operating budgets of the Institutes or from grant or contract lines. He also pointed out that the Paperwork Reduction Act, implemented over 10 years ago, severely restricted the information collection activities of Federal agencies. Although not offered as an excuse, this legislation does restrain such efforts and necessitates great selectivity in the types of information collected.

The representative from the National Advisory Council for Nursing Research stated that baseline data on training for nursing, dentistry, and veterinary science needed to be developed so that accurate projections for future needs could be made.

In concluding deliberations on the recommendations, Dr. Raub expressed appreciation for the valuable refinements proposed by Advisory Committee members and Council representatives. He further indicated that NIH staff would appropriately convey the concerns of the Committee members and Council representatives about the difficulties caused by the tradeoffs related to aspects of the current funding climate.

A 5-Year Research Strategy

Initiation of a 5-Year Research Strategy

Dr. Raub introduced for consideration a proposal for the development of a 5-year research strategy for NIH. He prefaced his remarks by noting the statement of the Secretary of DHHS that strengthening biomedical research is an explicit goal of the Department. Although the fact that research is central to DHHS efforts has been recognized by a succession of Secretaries, it has rarely appeared in the larger context of the issues to be addressed by the Department. The Secretary's stance has also been echoed by the Assistant Secretary for Health, who has called for bold and multiyear thinking.

After noting that the need to increase the number of research project grants emerges first in any consideration of long-term objectives for NIH, Dr. Raub summarized the negative impacts of the current low award rate including the outstanding projects that go unfunded, the migration of individuals out of research, the secondary effects on students observing their mentor's plight, and the frustration of peer reviewers. There have also been increased attacks on the peer review system itself and on the decisionmaking approach of the Councils. Some of the unhappiness with the genome project has been rooted in the belief that the money might be spent more productively on project grants. However, Dr. Raub maintained that, as important as the project grant system is, the growth of project grants must be accompanied by a complementary growth of other NIH mechanisms if NIH's desired orientation and balance is to be maintained. Further, to advocate a larger investment in NIH, expected outcomes must be expressed in a number of ways. They must be tied to crosscutting scientific issues affecting all Institutes; to health status indicators and the health status of minorities and other underrepresented groups; to the impact on the economy, particularly the pharmaceutical and biotechnological industries; and to the impact on the research milieu itself.

After this introduction, Dr. Moskowitz discussed the underlying rationale for the 5-year research strategy. One aspect of the rationale is the impact of scientific discovery. Scientific discoveries are leading to a better understanding of basic mechanisms of living organisms and diseases, a process that must continue. Momentum in the transfer of this information to clinical medicine must also be sustained. Fiscal pressures and priority-setting issues are other aspects of the underlying rationale. The extensive investment of public funds in biomedical research necessitates basing funding decisions on judicious long-range plans. Moreover, the increasingly capital-intensive nature of biomedical research necessitates clearer priorities within and across research fields. The balance of basic to applied research must also be justified. Further, issues related to congressional policymaking are also relevant to the initiative's rationale. It must be demonstrated that

biomedical research is a cost-effective strategic resource. A comprehensive research plan will also provide a framework for the development of new policy initiatives relevant to biomedical research, technology transfer, and improvement of public health. Finally, the rationale includes the significance of the planning initiative to NIH and the ICD's. The initiative will establish an NIH-wide framework around which a variety of research support mechanisms could be planned. It would also serve as an "umbrella plan" to further promote the efforts of the individual ICD's to support significant biomedical research.

Dr. Moskowitz then outlined the proposed steps to initiate the 5-year planning strategy. A panel of expert consultants, perhaps including economists and an ethicist, would be established to cover a variety of biomedical research areas. The panel's mandate would be to identify crosscutting biomedical research themes and directions; the current knowledge base, promising research options, and scientific opportunities; gaps within research themes and directions; and conditions under which opportunities could be pursued and gaps addressed. The panel would also be asked to note active growth points within particular subfields and to determine if the current dynamics of knowledge development ensure significant advances in those fields. The impact of scientific progress and discovery on mortality, morbidity, and quality of life; potential costs and health benefits; and resource requirements would also be identified. After a series of meetings, the panel would report the results of its deliberations and its recommendations at the December ACD meeting. Ultimately, the report would be sent to the Department for clearance and then to the appropriate congressional committees.

Discussion

During discussion of the presentations on the 5-year research strategy, it was emphasized that to achieve the goals of the planning initiative within the brief timeframe proposed, the effort would have to be integrated and coordinated with related activities of other outside organizations such as the NAS.

Council representatives and Committee members reacted favorably to the planned initiative. It was suggested that it should be promoted to increase its visibility outside the health research field and as a means of providing information to the general public, Congress, and the executive branch. The discussion concluded with a request by Dr. Moskowitz for written recommendations from Council representatives and the Advisory Committee on potential expert consultants and themes to be addressed by the panel.

Closing Remarks

In his closing remarks, Dr. Raub thanked the Committee members and Council representatives for their contributions to a productive meeting and expressed appreciation for their time and energy.

Summary and Conclusions

The Advisory Committee to the Director, NIH, with representatives of the National Advisory Councils and Boards of the NIH Institutes, met on June 1 to consider the report and recommendations of the NIH Task Forces for the Review of the NIH Biomedical Research Training Programs and to consider a new NIH effort to initiate a 5-year research strategy at NIH. After receiving status reports on activities related to continued progress in the administration of medical rehabilitation research at NIH and to strengthening the scientific review procedures of the NIH intramural research program, the focus turned to the principal purpose of the meeting, a consideration of the recommendations of the NIH Task Forces for the Review of the NIH Biomedical Research Training Programs. Presentations were heard on the broader context of research training from representatives of organizations concerned with research and higher education. The recommendations of the Task Forces on Physician Scientist Training, Training Opportunities in Clinical and Community-Based Designs and Methodology, and Predoctoral and Postdoctoral Training of Nonphysician Scientists, and the activities undertaken to implement Task Force recommendations were also summarized. While Advisory Committee members and Council representatives agreed with most of the recommendations made by the task forces, refinements in the language of the three recommendations dealing with length of training and the payback requirement were urged to ensure flexibility in implementing these recommendations. Committee members also believed that the recommendation for support of training in the areas of epidemiology and biostatistics required further internal attention as it relates to persons other than M.D.'s. No consensus was achieved on the recommendation for a two-tier cost of education allowance. Throughout these deliberations, Committee members repeatedly demonstrated great concern about the negative impact the current fiscal climate was having on NIH training activities and on the biomedical research enterprise as a whole. The second portion of the meeting focused on a new NIH effort to initiate a 5-year research strategy at NIH. Council representatives and Committee members reacted favorably to the planned initiative.

I hereby certify that, to the best of my knowledge, the foregoing minutes are accurate and complete.

Jay Moskowitz, Ph.D., Executive Secretary,
Advisory Committee to the Director, NIH

William F. Raub, Ph.D., Chairman,
Advisory Committee to the Director, NIH

Agenda

Appendix A

AGENDA

61st Meeting of the Advisory Committee to the Director National Institutes of Health

Review of the National Institutes of Health Biomedical Research Training Programs

Friday, June 1, 1990

Building 31C, Conference Room 10
National Institutes of Health
Bethesda, Maryland

8:30 a.m. Opening Remarks ..... Dr. William Raub

- Status Report on Activities Following the 60th Meeting of the Advisory Committee to the Director
- Introduction of the Subject of the Meeting.

I. RESEARCH TRAINING PROGRAM

9:00 a.m. Institute of Medicine Report on Manpower ..... Dr. Joe G. Baker

9:20 a.m. Discussion

9:30 a.m. Study of M.D./Ph.D. Training ..... Dr. Paul Jolly

9:50 a.m. Discussion

10:00 a.m. Report of the Association of American Universities
"The Ph.D. Shortage: The Federal Role" ..... Dr. Robert Rosenzweig

10:20 a.m. Discussion

10:30 a.m. Coffee Break

10:50 a.m. Physician Scientist Training ..... Dr. Jay Moskowitz

11:10 a.m. Training in Clinical and Community-Based
Study Designs and Methodology ..... Dr. Curtis Meinert

11:30 a.m.	Predoctoral and Postdoctoral Training of Nonphysician Scientists	Dr. Ruth Kirschstein
11:50 a.m.	Discussion	
12:15 p.m.	Lunch	
1:30 p.m.	Report of Activities to Implement Recommendations Contained in Report	Dr. George Galasso
1:50 p.m.	Discussion	Mr. Rodney Nichols (Discussion Leader)

II. THE 5-YEAR RESEARCH STRATEGY

3:00 p.m.	Initiation of a 5-Year Research Strategy	Dr. William Raub Dr. Jay Moskowitz
3:40 p.m.	Discussion	
4:00 p.m.	Closing Remarks	Dr. William Raub

Advisory Committee to the Director, National Institutes of Health

Appendix B

Advisory Committee to the Director, NIH

May 1990

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Advisory Council and Board Representatives

Appendix C

Advisory Council and Board Representatives

June 1, 1990

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Report of the Task Forces for the Review of NIH Biomedical Research Training Programs

Appendix E

Review of the National Institutes of Health Biomedical Research Training Programs

October 1989

FOREWORD

The Steering Committee is pleased to present this report on behalf of the three Task Forces established to review the biomedical research training programs of the National Institutes of Health (NIH).

Since their establishment in April 1989, the three Task Forces have been engaged, respectively, in review of traditional biomedical science-based training programs for physician scientists; development of an approach to train physicians and others in areas not being addressed adequately, e.g., epidemiology, biostatistics, and demography; and examination of the traditional predoctoral and postdoctoral training programs for nonphysician scientists. Members of the Task Forces want to express appreciation to those members of the scientific community and NIH staff who provided comments and resource information. Their efforts contributed substantially to this review. Appreciation is also expressed to Dr. Barbara Packard who served as rapporteur for this report.

The Steering Committee and members of the Task Forces are hopeful that this report will provide a framework for a productive research training effort and the preparation of biomedical scientists whose work will ensure the future success of the NIH mission.

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Dr. Ruth L. Kirschstein
Director
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Dr. Carl Kupfer
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EXECUTIVE SUMMARY

In April 1989, Dr. James Wyngaarden, Director, National Institutes of Health (NIH), established three Task Forces to review NIH biomedical research training programs in terms of:

- Traditional biomedical science-based training programs to develop physician scientists.
- Areas of research training not currently addressed adequately or systematically, e.g., clinical trial design and methodology, biostatistics, epidemiology, and population demography.
- Traditional predoctoral and postdoctoral training programs for nonphysician scientists.

The Task Forces met separately to consider issues related to their individual charges and to develop recommendations. A Steering Committee, consisting of the chairs of each Task Force, was established to integrate the outcomes of the Task Forces. This report represents the deliberations, conclusions, and recommendations of the three Task Forces. A total of seven major issues were identified and addressed during the review of the NIH biomedical research training programs:

- Early recruitment of talented individuals into biomedical research careers.
- Optimal structure of postdoctoral research training for professional doctorates.
- Integration of research training with clinical certification requirements and the relationship of research training to clinical training.
- New approaches and opportunities for research training.
- Trainee stipends and cost of education.
- K-series awards.
- Data collection, monitoring, and evaluation.

Major conclusions and recommendations are summarized below.

Early Recruitment of Talented Individuals Into Biomedical Research Careers

Currently, inadequate numbers of individuals with professional doctorates are entering biomedical research careers. Studies of existing short-term training programs for health professional students suggest that such programs are effective in stimulating interest in research careers. Early recruitment efforts will be enhanced by providing opportunities for predoctoral research experiences as part of institutional training grant programs.

RECOMMENDATION

PROFESSIONAL PREDOCTORAL STUDENTS SHOULD BE ELIGIBLE FOR TRAINING ON INSTITUTIONAL TRAINING GRANTS DURING THE SUMMER OR ELECTIVE TIME FOR PERIODS OF BETWEEN THREE AND 12 MONTHS WITH A MAXIMUM OF 12 MONTHS. A MINIMUM OF SIX MONTHS SHOULD BE ENCOURAGED.

Optimal Structure for Postdoctoral Research Training

The objective of the National Research Service Award (NRSA) training programs is preparation of independent, productive researchers. A strong relationship exists between the duration of postdoctoral research training and subsequent success in receiving NIH independent research support. Research training for periods of 12 months or less is inadequate to prepare professional doctorates for successful research careers. It was concluded that, in most cases, postdoctoral research training for professional doctorate recipients should extend for a period of up to five years.

A limited commitment on the part of professional doctorate trainees and a lack of selectivity on the part of the training director may be two factors that result in ineffective institutional training grants. Revision of the payback requirement, coupled with a two-year minimum requirement for professional doctorate recipients appointed to training grants, should result in recruitment of trainees with increased commitment. Rigorous review of training program success in retaining individuals through completion of their initial training commitment will improve selectivity by training directors.

Applications for institutional NRSA grants need to include information in a standardized, tabular form in order to evaluate performance and possibly expedite review.

No apparent relationship exists between training grant size and trainee success, but review will ensure that the requested number of trainees is consistent with individual BID policies and the training institution's resources and ability to provide appropriate preceptors. Review also will consider the apparent advantage of grant applications that propose training both professional doctorates and academic doctorates in the same program. Special training experiences at institutions other than parent training institutions may be beneficial in certain cases, but provision for the training must be included in the grant application or subsequently approved by NIH staff.

RECOMMENDATION

A MINIMUM OF TWO YEARS OF TRAINING SHOULD BE REQUIRED FOR ALL PROFESSIONAL DOCTORATE APPOINTEES TO INSTITUTIONAL NRSA GRANTS. TRAINEES SHOULD BE ENCOURAGED TO APPLY FOR FURTHER RESEARCH TRAINING AND CAREER DEVELOPMENT THROUGH NATIONAL COMPETITION. TRAINING GRANT APPOINTMENTS MAY BE

EXTENDED BEYOND TWO YEARS UPON THE RECOMMENDATION OF THE TRAINING DIRECTOR AND WITH THE CONCURRENCE OF THE NIH.

THE NIH/DHHS SHOULD PLAN FOR MODIFICATION OF THE PAYBACK REQUIREMENT OF THE NRSA REAUTHORIZATION LEGISLATION.

REVIEW OF COMPETING RENEWALS FOR NRSA TRAINING GRANTS SHOULD FOCUS UPON PERFORMANCE, IN TERMS OF THE PREPARATION OF TRAINEES FOR PRODUCTIVE RESEARCH CAREERS.

NUMBERS OF TRAINEES IN TRAINING PROGRAMS SHOULD BE CONSISTENT WITH INDIVIDUAL BID POLICIES AND THE INSTITUTION'S RESOURCES.

THE PRESENCE OF BOTH M.D. AND PH.D. TRAINEES IN THE SAME PROGRAM SHOULD BE CONSIDERED FAVORABLY IN THE REVIEW OF NRSA TRAINING GRANT APPLICATIONS.

SPECIAL TRAINING EXPERIENCES AWAY FROM THE TRAINING INSTITUTION MAY BE PROPOSED AS PART OF THE TRAINING GRANT APPLICATION OR SUBSEQUENTLY TO NIH STAFF.

Integration of Research Training With Clinical Certification Requirements and the Relationship of Research Training to Clinical Training

The revised research training structure can be effectively integrated with the requirements for clinical training. The existing investigator track for board certification permits research training and satisfies the requirements for both board certification in internal medicine and subspecialty certification within the normal clinical training period. Differing approaches to integrating research training with clinical training are likely to exist, and they can be permitted as long as NRSA training grant appointments are not used to support clinical training.

RECOMMENDATION

MULTIPLE PATHWAYS SHOULD BE PERMITTED TO ACCOMMODATE THE NEEDS FOR CLINICAL CERTIFICATION WITHIN THE CONTEXT OF THE RESEARCH TRAINING EXPERIENCE OF TWO OR MORE YEARS.

New Approaches and Opportunities For Research Training

Expanded opportunities for research training and research career development are required to meet the demand for individuals capable of designing, implementing, and analyzing epidemiologic studies and clinical trials, as well as for individual experts in biostatistics.

Individual predoctoral fellowships are currently being used effectively within the Public Health Service. These fellowships may have potential

to complement NIH predoctoral training grants by increasing the number of institutions available for training. Such possibilities demonstrate the need for periodic reviews of the relevance of existing training programs to the current and future needs of the sponsoring BIDs. New programs should be initiated and old programs discontinued as appropriate.

RECOMMENDATION

ADVANCED PROGRAMS OF STUDY AND K-SERIES AWARDS SHOULD BE SUPPORTED IN EPIDEMIOLOGY, BIOSTATISTICS, OR RELATED TOPICS TO INCREASE PREDOCTORAL AND POSTDOCTORAL RESEARCH TRAINING OPPORTUNITIES. CURRENT NIH MECHANISMS ALSO SHOULD BE USED TO SUPPORT MASTER'S DEGREE-LEVEL PROGRAMS AND NONDEGREE CERTIFICATE PROGRAMS THAT FOCUS ON THESE TOPICS.

THE OPPORTUNITY FOR INDIVIDUAL PREDOCTORAL FELLOWSHIPS TO ADDRESS SPECIFIC NIH TRAINING NEEDS SHOULD BE REVIEWED.

NEEDS IN NEW RESEARCH AREAS AND APPROACHES FOR NIH RESEARCH TRAINING TO RESPOND TO THESE NEEDS SHOULD BE EVALUATED ON AN ONGOING BASIS.

Trainee Stipends and Cost of Education

Current NRSA stipend levels are below salaries paid to housestaff with comparable years of postgraduate experience. Consequently, individuals who elect to pursue research training are forced to accept a reduced salary. The NRSA stipend structure can be revised so that it provides an incentive for recipients of professional doctorates interested in research careers. Increased stipend levels also are needed for predoctoral and postdoctoral nonphysician scientist trainees.

Inclusion of some support for the cost of education is appropriate in institutional research training grants. However, with constantly rising tuition charges, declining NIH research training budgets in terms of constant dollars, and decreases in the number of predoctoral trainees, the NIH must seek approaches to stabilize the situation. A "two-tier cost of education (CoE) allowance" for predoctoral training, i.e., one level for private institutions and another for public institutions, would control the portion of the NIH training budget allocated to educational expenses. The annual decision regarding the CoE allowance can be made with the objective of maintaining at least a constant number of trainees. These two-tier CoE levels are also applicable to special NIH training programs.

The mechanism for research training support should be made more comparable across Federal agencies.

RECOMMENDATION

POSTDOCTORAL STIPENDS FOR PROFESSIONAL DOCTORATES SHOULD BE AT LEAST AS ATTRACTIVE AS CURRENT HOUSESTAFF SALARIES. STIPEND LEVELS ALSO SHOULD BE INCREASED FOR ACADEMIC TRAINEES. ANNUAL STIPEND INCREASES ARE NECESSARY TO COMPENSATE FOR INCREASED LIVING COSTS.

THE PROPOSED "TWO-TIER COST OF EDUCATION ALLOWANCE" AS A MECHANISM TO LIMIT TUITION PAYMENTS IS REAFFIRMED. THE SAME GENERAL PRINCIPLES SHOULD BE APPLIED TO SPECIAL NIH RESEARCH TRAINING PROGRAMS.

FEDERAL AGENCIES SUPPORTING BIOMEDICAL RESEARCH TRAINING SHOULD EXPLORE WAYS OF MAKING THEIR SUPPORT MECHANISMS MORE EQUIVALENT.

K-Series Awards

A full five years of career development support may be more than is needed for all individuals who have completed the two or more year appointment on a research training grant. A three-year career development award, when coupled with the two-year training experience, would provide professional doctorates with the total of five or more years of research experience deemed necessary to prepare them for a successful research career.

Salaries for K-series awards should be higher than corresponding stipends for training grant appointments. In this way, trainees will be offered a further incentive to seek independent support through national competition.

RECOMMENDATION

THREE-YEAR K-SERIES AWARDS SHOULD BE MADE AVAILABLE FOR PROFESSIONAL DOCTORATES. SALARIES SHOULD BE INCREASED TO $50,000 PER YEAR ON K-SERIES AWARDS.

Data Collection, Monitoring, and Evaluation

Regular reviews and analyses are necessary to determine the effectiveness of the NRSA training programs. A number of data sources are available to the NIH that offer opportunities for important insights into program performance. At present, they are not explored to the fullest extent possible. Collecting additional data will permit a more complete assessment of NIH training activities.

RECOMMENDATION

STANDARDIZED INFORMATION NECESSARY TO ASSESS PROGRAM PERFORMANCE SHOULD BE COLLECTED ON ALL INDIVIDUALS AND INSTITUTIONS RECEIVING NRSA RESEARCH TRAINING SUPPORT.

AVAILABLE NIH TRAINING DATA SHOULD BE ANALYZED FURTHER AND NEW DATABASES ESTABLISHED AS NEEDED.

I. BACKGROUND

A. Overview

The contribution of research training to the development of productive researchers and the advancement of biomedical science is widely recognized. Continued research progress can be ensured only if adequate numbers of appropriately trained individuals pursue careers in biomedical research.

On April 19, 1989, Dr. James B. Wyngaarden, Director, National Institutes of Health (NIH), reemphasized the importance of research training to the mission of the NIH by establishing three Task Forces to review the NIH biomedical research training programs, identify and assess issues, and make recommendations for improvements. He requested that the Task Forces complete their review so that implementation of recommendations could begin with the next major application cycle, i.e., January 1990. He asked them to focus upon:

> Traditional biomedical science-based training programs to develop physician scientists.
>
> Areas of research training not currently addressed adequately or systematically, e.g., clinical trial design and methodology, biostatistics, epidemiology, and demography.
>
> Traditional predoctoral and postdoctoral training programs for nonphysician scientists.

The NIH training program currently consists of a series of mechanisms of support, including the institutional training grant (T-series) and the individual fellowship award (F-series) supported through National Research Service Award (NRSA) funds, and the career development awards (K-series) supported through research project grants. While most trainees are supported initially on a training grant, individual fellowship grants are available at any stage of research training. Further development of research skills is supported through the career development awards. Individuals with advanced research experience may compete, at any time, for independent research support through either a First Independent Research Support and Transition (FIRST) award (R29) or a research project grant (R01) award.

This report is based on the deliberations of the three NIH Task Forces.

B. Task Force Procedures

1. Task Force on Physician Scientist Training

The Task Force was convened in May 1989, and charged with the responsibility to review the NIH training programs for physician

scientists and make recommendations for their improvement. A number of indicators suggest that improvements are, in fact, needed:

> The percentage of M.D. trainees who subsequently apply for and receive NIH research grants is unacceptably low.
>
> More than 60 percent of M.D.s are trained for 12 months or less. NIH data indicate that those who are trained for longer periods are more successful in competing for NIH support.
>
> Postdoctoral positions on training grants are sometimes used to support individuals other than those committed to a career in biomedical research.
>
> Some training grants have not been effective in producing physician scientists.

During its review of NIH training programs for physician scientists, the Task Force was asked to consider the following questions about the current training grant program:

> Is the training grant still the best way to introduce physicians to research?
>
> Should it be modified . . . or perhaps phased into a K-series . . . award to provide an adequate continuum of training?
>
> Are there ways to make the current NIH research training program more effective?
>
> Should the training grants be phased out for physician scientists or reduced in favor of the K-series approach?

The Task Force met eight times between May and August 1989. Dr. Wyngaarden met with members in May to deliver the formal charge and discuss several aspects of the topic with them. Over the course of their meetings, the members considered a number of issues, including:

> Early recruitment of talented individuals into biomedical research careers.
>
> Optimal structure of postdoctoral research training for professional doctorates.*
>
> Integration of research training with clinical certification requirements and the relationship of research training to clinical training.
>
> Trainee stipends.
>
> K-series awards for professional postdoctoral candidates.

* The Task Force designated the term "professional doctorates" to encompass other relevant professional degrees as well as M.D.s.

Background data were provided to the Task Force on these issues. In addition, discussion papers were prepared for review on (1) the structure and nature of an optimal research training program for professional doctorates, (2) a revised K-series award, (3) trainee stipends, and (4) the training grant application process and review criteria.

The Task Force shared its ideas with:

The National Heart, Lung, and Blood Advisory Council (NHLBAC).

The National Institute of Arthritis and Musculoskeletal and Skin Diseases Advisory Council (NIAMSAC).

In order to receive the broadest range of consultation, the Task Force members also invited the following individuals to meet with them:

Dr. John A. Oates, Jr.
Chairman, Department of Medicine
Vanderbilt University
Member, NHLBAC

Dr. William Hazzard
Chairman, Department of Medicine
Bowman Gray School of Medicine
Member, American Board of Internal Medicine (ABIM)

Dr. Arthur Nienhuis
Chief, Clinical Hematology Branch, NHLBI
Member, ABIM

In addition, several letters were received from members of the scientific community, organizations, and NIH staff, who shared their views on the research training of professional doctorates with the Task Force.

2. Task Force on Training Opportunities in Clinical and Community-Based Study Designs and Methodology

The Task Force was convened on June 19, 1989, and Dr. Wyngaarden delivered the formal charge to develop an approach to train physicians and others in areas that are not being addressed adequately or systematically, e.g., clinical trial design and methodology, biostatistics, epidemiology, and demography. Members subsequently discussed features of advanced programs for research training and career development in epidemiology, biostatistics, or related topics as well as additional programs for health professionals. The Task Force also considered issues of eligibility and mechanisms of support. A draft Task Force report was reviewed at a second meeting on June 29, 1989. Thereafter, the Task Force used mail review to develop and complete an interim report for the Director, NIH, and for consideration at the July 27, 1989, meeting of BID Directors.

3. Task Force on Predoctoral and Postdoctoral Training of Nonphysician Scientists

The Task Force on Predoctoral and Postdoctoral Training of Nonphysician Scientists met six times. At its first meeting on May 23, 1989, Dr. Wyngaarden charged members to examine traditional predoctoral and postdoctoral training programs for nonphysician scientists. He indicated that the outcomes for nonphysician scientists who previously had NIH research training support were good.

A number of important issues were identified for consideration, including:

> Data collection and evaluation studies.
>
> Problems regarding tuition and stipends.
>
> New approaches, opportunities, and needs for research training.

Working groups of the Task Force were established and each was assigned one of these topics. The full Task Force reviewed and modified draft reports from the working groups. A preliminary report, including a series of recommendations, was prepared and submitted for consideration by the Director, NIH, and the BID Directors.

C. History of NIH Research Training Programs

1. Early Training Authorities and Activities

The initial legislation that authorized the NIH to conduct and support training was provided in 1930 by the Ransdell Act (P.L. 71-251), the same legislation that formally established the then National Institute of Health. Thus, from its inception, the NIH has been directed to recognize training as one of its major responsibilities. Under the terms of the Ransdell Act, individual scientists could be designated ". . . to receive fellowships . . . for duty in the National Institute of Health . . ." or ". . . for the prosecution of investigations in other localities and institutions in this and other countries . . . ."

When Congress passed the National Cancer Act (P.L. 75-244) in 1937 and thereby established the first of the disease-specific institutes, it included in the legislation a provision for training in cancer. This provision led to the first major fellowship program supported by the U.S. Government. According to terms of the Act, research fellowships established under it were to provide ". . . such stipends or allowances . . . as the Surgeon General may deem necessary to procure the assistance of the most brilliant and promising research fellows from the United States or abroad . . . ." Because the National Cancer Act also authorized ". . . training and instruction in technical matters relating to the diagnosis and treatment of cancer . . .", the National Cancer Institute (NCI) focused its initial training efforts on postdoctoral research fellows and

clinical training for physicians to improve their capability in diagnosis and therapy. Awards for both kinds of training were made to individuals selected by NCI staff.

In 1946, the Public Health Service (PHS) Act provided explicit authority for grants for the support of training, and this authority was extended and expanded in the National Heart Act (P.L. 80-655) of 1948. The text of the National Heart Act specifically provided for the possibility of grants for training programs. It permitted the new National Heart Institute to:

> "... establish and maintain traineeships, in the Institute and elsewhere in matters relating to the diagnosis, prevention, and treatment of heart disease ... the number of persons receiving such training and instruction, and the number of persons holding such traineeships, to be fixed by the Council, and in addition, provide for such training, instruction, and traineeships through grants ...."

Also, in 1948, the National Dental Research Act (P.L. 80-755) followed the pattern of authority for training set forth in the National Heart Act. The PHS Act amendments (P.L. 81-692) of 1950, which established the National Institute of Arthritis and Metabolic Diseases and the National Institute of Neurological Diseases and Blindness, provided very broad training authorities for the new Institutes and extended those authorities to all existing Institutes. Subsequent legislation establishing additional Institutes all contain comparably broad training authority.

The first departure from a system of awards to individuals occurred in 1948 with the initiation of undergraduate training grants. These training grants were made to professional schools to strengthen their undergraduate teaching capabilities in selected fields. The grants provided the same amount for each institution of a given type. They included no stipends for individuals but instead, provided funds for use at the recipient school's discretion to purchase equipment, acquire instructional material, and offer faculty salary support.

2. Changes in NIH Training Programs

Significant changes have occurred in NIH training programs since the 1930 passage of the Ransdell Act. The training grant mechanism was modified by the National Heart Institute in 1950 to provide support for graduate-level training and include funds for training stipends. In addition, the new graduate-level training grant differed from its undergraduate predecessor in that the award amounts varied from one institution to another. A further differentiation between the graduate and undergraduate training grant was subsequently introduced. Grantee institutions were permitted increased latitude in the management of the graduate grants; they were allowed to select trainees without prior central NIH review and to set the level of individual stipends. With these modifications, the basic pattern of the institutional training grant was developed.

An important change occurred in 1954, when part-time fellowships, usually for summer work, were initiated to stimulate the interest of medical and dental students in research and permit early identification of talent. Later in 1957, a program was established that permitted medical and dental students to spend a year in research between their preclinical and clinical years. It was also about this time that some training programs began to focus on the needs of faculty and research. Gradually, the use of clinical traineeships was phased out. The Division of Research Grants provided the initial NIH focus for support of research training in fundamental disciplines related to health, e.g., biophysics, epidemiology, and biostatistics. In 1958, these training grants and predoctoral training programs from the established Institutes were transferred to the Division of General Medical Sciences, now the National Institute of General Medical Sciences.

These developments, as well as a growing demand for scientists and teachers, an adequate pool of potential trainees, and expansion of the biomedical research effort, led to rapid expansion of NIH training programs in the late 1950s and early 1960s. The number of trainees supported by NIH under its original training authority reached over 16,000 in 1969. By 1971, NIH training grants and fellowships supported or assisted 37.5 percent of the nation's full-time graduate students in the medical sciences and 21 percent in the life sciences. However, in its presentation of the fiscal year (FY) 1974 budget, the Administration made an attempt to eliminate the award of all new training and fellowship grants.

Congress responded by providing new authority with the National Research Service Award Act of 1974 (Title I, P.L. 93-348). This Act abolished all previous training authorities under the PHS Act and consolidated them under the National Research Service Award (NRSA). It provided both predoctoral and postdoctoral support to individuals and additional support to institutions training such individuals. It also provided for a payback requirement* as a condition of receiving support. This provision was intended to discourage the use of this authority to support clinical training of physicians. In implementing the provisions of the NRSA, the NIH established individual postdoctoral fellowships (F32s) and institutional training grants for predoctoral and postdoctoral students (T32s).

During the 1970s, there was a decline in the number of trainees. For the first few years following passage of the NRSA legislation, NIH research trainees were supported by a combination of remaining commitments under the old training authority and the new NRSA authorizations.

* For each year of NRSA support, recipients were required either to serve for an equivalent period of time in research, teaching, or providing medical care to an underserved area or to reimburse the government for the cost of the training.

Since 1979, the number of full-time research training positions budgeted for the NIH under the NRSA has been relatively stable, fluctuating between a high of $11,197 in 1979 and a low of $10,382 in 1986. The number of physicians was 11,181 in 1987.

The programmatic evolution of training grants was gradual across the NIH, and emphasis was individualized depending on the particular fields of science needed to carry out the mission of a Bureau, Institute, and/or Division (BID). The versatility and flexibility of the training grant made it an ideal vehicle for this effort.

The fundamental goal of the NIH research training programs is to prepare well-trained, highly qualified, and productive research investigators in fields relevant to the advance of biomedical science. The NRSA is the only current authority under which the NIH supports basic preparation of individuals for careers in biomedical research. Through a system of institutional training grants and individual fellowships, the trainee or fellow receives a stipend for full-time concentrated study and may elect, under supervision, an individual research focus. Funds are awarded for predoctoral and postdoctoral stipends, and for tuition where warranted, with a modest allocation to the institution to defray training-related expenses not covered by tuition.

II. DISCUSSION AND RECOMMENDATIONS

A. Early Recruitment of Talented Individuals Into Biomedical Research Careers

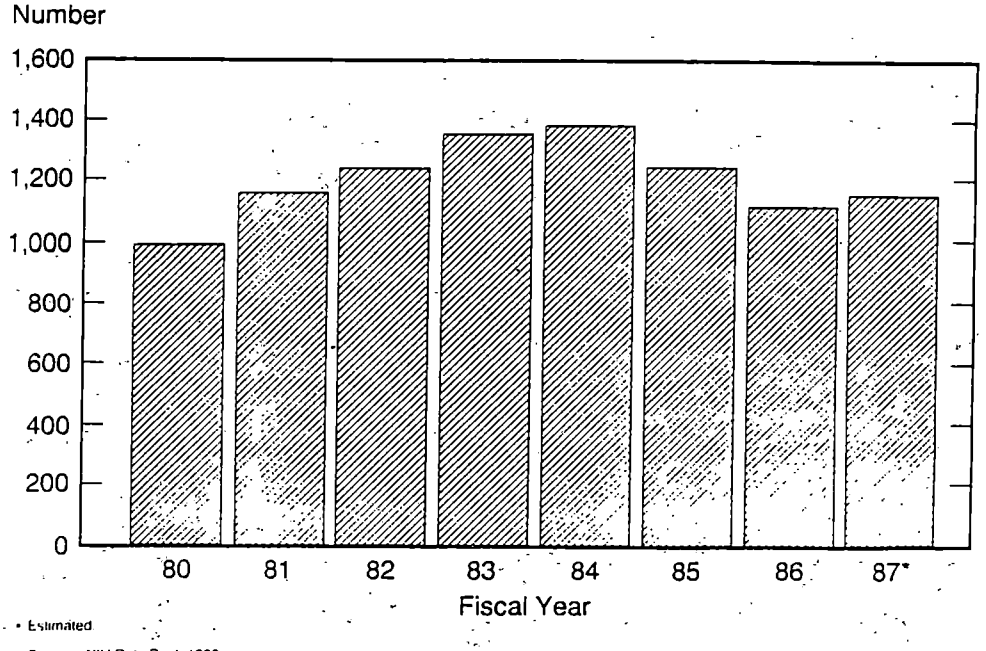
1. Current NIH Programs

The Task Force on Physician Scientist Training is concerned that inadequate numbers of individuals with M.D.s or other professional doctorates are entering into research careers. A study of the impact of the short-term training program for health professional students (T35) showed that program participants were twice as likely to express an interest in a research career at the time of graduation as were individuals who did not have the benefit of such an experience. Additionally, T35 trainees have research goals and demonstrate a relatively greater appreciation of the value of a basic science foundation preparatory to a research career. The NIH supported an estimated 1,156 appointments of individuals for short-term training in FY 1987 (Figure 1). Currently, the National Institute of Neurological Disorders and Stroke (NINDS) supports a limited number of short-term traineeships on its institutional NRSA training grants to provide professional predoctoral students with two or more "off-quarter" opportunities for involvement in research.

Such a program supported as part of the training grant may offer an effective mechanism for stimulating research interest among professional predoctoral students. It was agreed that both T35 and T32 training mechanisms are important training opportunities for professional predoctoral students and that both are needed.

Figure 1

Short-Term Research Training (T35s)
Number of Appointments



* Estimated

Source: NIH Data Book 1988

2. Early Recruitment Opportunity for Training Grants

The intent of the training program for professional predoctoral students is to provide opportunities for participation in biomedical research training over the course of, but prior to the completion of, professional doctorate training. The incorporation of training of professional predoctoral students into the institutional training grant offers several advantages. It introduces individuals, at an early stage of their professional training, to the concept of a continuum of research training and career development. The faculty of the training grant is available to the participating students, and the training director is expected to report on progress and success of the training. Students can become predoctoral trainees on training grants either at the institution from which the degree will be conferred or at another institution. Additionally, a participant in the predoctoral program can continue postdoctoral training on a training grant either at the institution from which the degree was conferred or at another one.

More opportunities, in addition to those currently available, are needed to stimulate interest in research careers among predoctoral students in health professional schools. Inclusion of professional predoctoral students on training grants will enhance efforts of early recruitment of talented individuals into biomedical research careers.

RECOMMENDATION

Eligibility for training on an institutional training grant should be extended to include professional predoctoral students, whose training would be in summer or elective time for periods of between three and 12 months with a maximum of 12 months. A minimum of six months should be encouraged.

B. Optimal Structure of Postdoctoral Research Training

1. Length of Training

Early in its deliberations, the Task Force on Physician Scientist Training addressed the issue of the length of research training required to prepare professionally trained individuals for independent research careers. Data were reviewed that showed a strong relationship between the duration of postdoctoral research training and subsequent success in receiving NIH independent research support. The preparation of independent, productive researchers is the underlying objective of the NRSA Training Program. An important measure of the level of research development of trainees is their likelihood of submitting applications for and receiving NIH research grant support. While the current NRSA program permits support for postdoctoral appointments of up to 36 months, NIH data show that more than 60 percent of professional doctorate degree recipients are appointed to training grants for a total of 12 months or less (Figure 2). Other data indicate that the percentage of

M.D. trainees who became NIH grant applicants and awardees has been decreasing since FY 1976.

An analysis of professional postdoctoral trainees, FY 1976-1982, who subsequently became NIH grant applicants and awardees showed that the longer the period of training, the more likely an individual trainee is to apply for and receive NIH research grant support (Figure 3). The Task Force recognized that individuals may receive research training support from non-NIH sources. However, the fact remains that, overall, M.D.s have low NIH grant application and award rates.

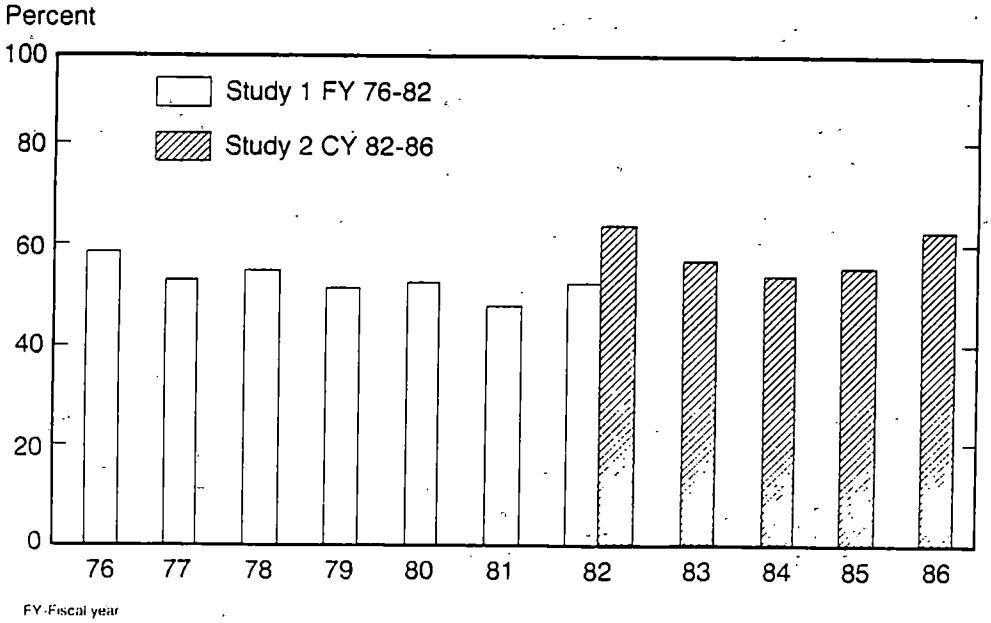
The Task Force and all of its consultants were unanimous in concluding that 12 months of postdoctoral research training is inadequate to prepare most individuals for independent research careers and that training should, in most cases, extend for a period of up to five years. Members expressed enthusiasm and confidence in the institutional training grant as a mechanism of support. They would like to see it more effectively utilized, particularly for professional postdoctoral training.

2. Training Structure

The apparent ineffectiveness of a number of training grants in producing physician scientists focused attention upon the role of institutional training grants in a redesigned research training structure. The lack of success of some training programs may be due to a limited commitment to research on the part of the trainees and to a lack of selectivity on the part of the training directors.

Figure 2

Postdoctoral MD Trainees Who Trained 12 Months or Less

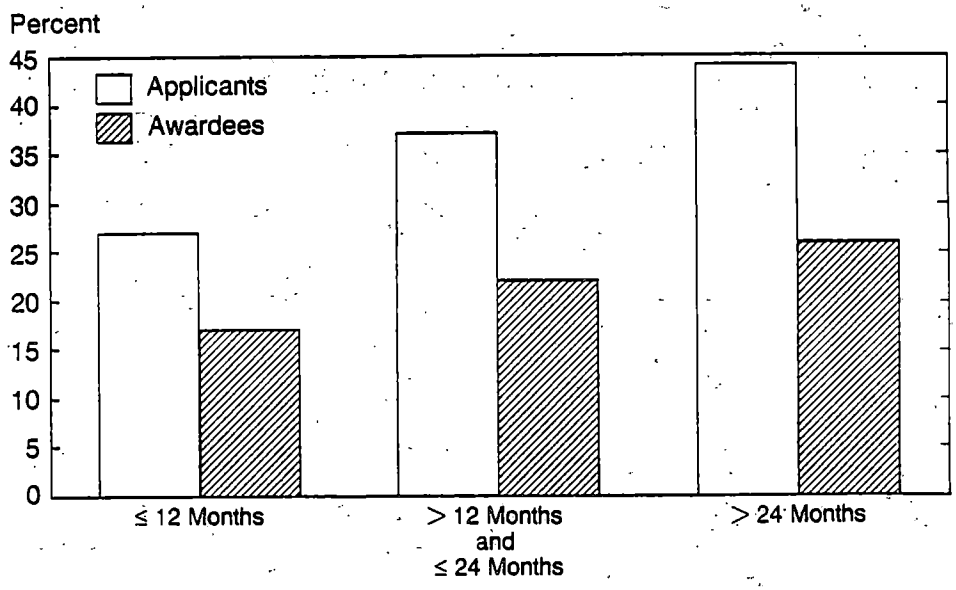


FY-Fiscal year
CY-Calendar year
Source: NIH, OD-OSPL

Figure 3

Postdoctoral MD Trainees Who Became NIH Grant Applicants and Awardees

FY 76 to 82



The requirement of a minimum of two years of research training and the modification of the NRSA payback requirement will serve to increase commitment on the part of trainees. With a minimum appointment period of two years instead of nine months, only individuals with a real interest in research careers will be likely to accept appointments. Incentive to complete the minimum appointment period would be provided by modifying the payback requirement so that it is incurred by the first year of training and satisfied by successful completion of the second year. It was recognized that the proposed modification to the payback requirement will need legislative action. The payback requirement also will need to be changed for the first year of an individual fellowship grant award (F32) to reflect the corresponding change for training grant awards. The Task Force on Predoctoral and Postdoctoral Training of Nonphysician Scientists believes that the payback provisions for such individuals also should be reconsidered. In view of the proposed modification of the payback requirements for trainees who are holders of professional doctorate degrees and the need for legislation to make such a change, NIH should develop an overall plan that addresses the entire payback requirement.

The need for research training opportunities extending beyond the first two years of training was considered. It was decided to allow optional appointments for a third or, in exceptional circumstances, fourth year on a training grant. While it was readily agreed that training directors should still be permitted to select individuals for research training, there was a concern about the appropriateness of delegating to them the decision to extend support to a trainee beyond the first two years.

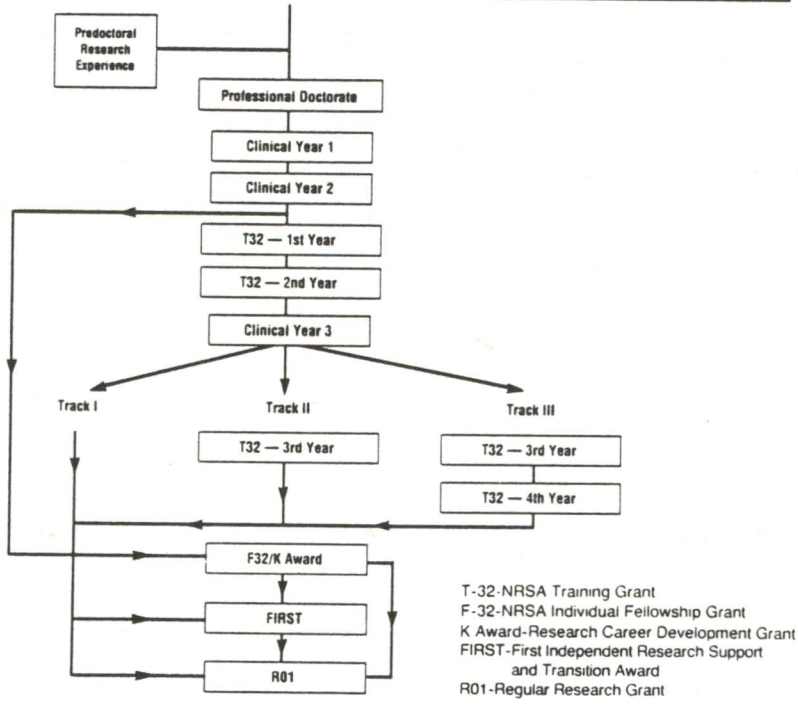
However, it was recognized that a rigorous review of the success of training programs in preparing individuals for independent research careers, when coupled with an NIH review of appointments for a third or, in exceptional cases, a fourth year of training, could be effective in ensuring that such appointments are appropriate. The proposal for a revised research training grant program for professional doctorates is illustrated in Figure 4. Multiple pathways are possible.

Improved selectivity by training directors can be ensured by rigorous review of training program success in retaining individuals through completion of the initial training commitment. Task Force members agreed that institutions should lose both training positions and funds for training positions filled by individuals who leave the program before completing their training experience. However, if a trainee receives an alternate award, such as an NIH individual fellowship or K-series award, or an equivalent award from non-NIH sources, a request for the balance of time and funds for the training position could be submitted to NIH staff for consideration.

3. Application and Review Procedures

Revised requirements for institutional NRSA training grant applications were developed by the Task Force. Applications will now be expected to convey aims that are consistent with the revised research training program and to describe how they will be addressed. In addition, certain information will be required in a standardized, tabular form to expedite review. The tables will include:

Figure 4
Research Training For Professional Doctorates



Current grant and contract research support and training support of the proposed training faculty.

Preceptor experience of present and proposed faculty supported by NRSA research training grants, NRSA fellowships, and by other means.

Research publications by trainees during the past five years.

Applications submitted and awards received by trainees for research support from NIH and other sources during the past five years, including those where they participated as a co-investigator.

Other support for training and current number of trainees of participating faculty.

In particular, trainee recruitment, selection, and activities will be described more fully and increased emphasis placed on the likelihood of the proposed program to achieve the stated aims on the basis of past record.

Revised review criteria include:

Past record of preceptors in research training.

Design and direction of the training program.

Caliber of preceptors.

Training environment, including attention to ethical standards of research.

Recruitment and selection plans for trainees, including underrepresented minorities and women.

Available training experiences and activities.

Career development plans and tracking process for trainees.

4. Other Aspects

Three other aspects of research training programs were addressed. It was agreed that arbitrary limits should not be placed by NIH upon the number of trainees permitted on a training grant since available data show no relationship between training program size and the subsequent development of trainees into independent researchers. Instead, the number of trainees should be consistent with individual BID policies and the institution's resources and its ability to provide appropriate preceptors. It also was agreed that the presence of both M.D. and Ph.D. trainees should be considered in the review of research training grant applications. Data indicate that M.D. trainees who are trained in programs that also train Ph.D.s are more likely to apply for and receive independent NIH research support than M.D. trainees who train only with other M.D.s. Finally, it was agreed that trainees could be allowed to spend up to one year in a training experience away from the parent

institution, with continued stipend support from the training grant. However, such a training experience could only be supported by a training grant if it was included either as part of the training grant application or subsequently approved by NIH staff.

RECOMMENDATION

The proposal for a revised training grant program includes a requirement for a minimum of two years of training for all appointees to institutional NRSA grants. After that time, trainees should be encouraged to apply for support for further research training (F32) and career development (K08, K11) through national competition. However, training grant appointments could be extended for an additional one or, in exceptional circumstances, two years upon the recommendation of the training director and with the concurrence of the NIH.

The NIH should develop a plan for appropriate modification of the payback requirement of the NRSA reauthorization legislation.

Review of competing renewals for NRSA training grants should focus upon performance. In particular, the review should consider the:

- Past record of preceptors in research training.
- Design and direction of the training program.
- Caliber of preceptors.
- Training environment, including attention to ethical standards of research.
- Recruitment and selection plans, including minorities and women.
- Available training experiences and activities.
- Career development plans and tracking process for trainees.

The presence of both M.D. and Ph.D. trainees in the same program should be considered favorably in the review of research training grant applications.

The number of trainees permitted on a training program should be consistent with individual BID policies and the institution's resources, including its ability to provide appropriate preceptors.

Individual trainees should be allowed up to one year of special training experiences at institutions other than the parent institution with continued stipend support from the training grant, if proposed as part of the training grant application.

C. Integration of Research Training With Clinical Certification Requirements and the Relationship of Research Training to Clinical Training

In developing the proposal for a revised research training structure, the Task Force on Physician Scientist Training focused first upon the extent and nature of training required to prepare recipients of professional doctorates for independent research careers. It was realized, however, that any revision to the existing training structure would have to be compatible with the requirements for board certification. Therefore, views of representatives of the scientific community who were familiar with the clinical training requirements for board certification were sought.

Based upon the information received, it appears that the revised research training structure can be effectively integrated with the requirements for clinical training. An accepted investigator track for board certification already exists that permits qualified individuals to credit two years of intensive research experience toward the training time required for board certification in internal medicine. As a consequence, an individual following the investigator track can satisfy the requirements for internal medicine and a subspecialty in the same period of time required for individuals who pursue a clinical training program.

The integration of the proposed research training structure with existing investigator track for clinical training is illustrated in Figure 4. Given the numerous possibilities for integrating clinical training requirements into a research training program and the likelihood of wide variation in individual preferences, the Task Force elected not to endorse any particular approach. Instead, the Task Force endorsed the concept of permitting individual training grant programs flexibility in accommodating the needs for clinical training.

However, the use of the training grant mechanism to support clinical training is unacceptable. It is apparent that postdoctoral positions on training grants are sometimes used to support individuals other than those committed to careers in biomedical research. As Dr. Wyngaarden stated in a November 15, 1984, letter to NRSA training directors,

> "Since the goals of research training are clearly differentiated from the goals of clinical specialty training, the use of the training grant solely to meet specialty board requirements is a serious abuse of the mechanism. (Some specialty boards permit a year of research to count towards board eligibility. NRSA support for this period is warranted only if the trainee has shown clear interest in a research career.)"

The Task Force recognized that the NRSA training grant continues to be used inappropriately for clinical training by some training directors. As proposed earlier (Section B) in this report, improvements in

selection of trainees by training directors, loss of training positions and funds for positions filled by individuals who leave the program before completing their training, the revised review criteria, and modification of the payback provisions are expected to prevent this practice.

RECOMMENDATION

Multiple pathways should be permitted to accommodate the needs of individual trainees for specialty and subspecialty certification within the context of meeting the two-year required minimum research training experience.

D. New Approaches and Opportunities for Research Training

1. Programs in Epidemiology, Biostatistics, or Related Topics

The increased research focus on prevention of disease and on population-based studies requires expanded predoctoral and postdoctoral research training as well as research career development opportunities in the design, implementation, and analysis of various types of epidemiologic studies and clinical trials. (Clinical trials are defined as prospective evaluations of the diagnostic, preventive, or therapeutic effects of a drug, device, lifestyle, or procedure used or intended for use in the practice of medicine.)

The Task Force on Training Opportunities in Clinical and Community-Based Study Designs and Methodology developed a new approach for advanced programs in epidemiology, biostatistics, applied prevention research, or related topics. These programs, usually three to four years in duration, would include both didactic study and practical experience. Predoctoral training programs that lead to a Ph.D. or equivalent degree would be encouraged. Training will be based in institutions where the faculty is actively engaged in epidemiologic studies and clinical trials. Individuals who complete training would be capable of assuming leadership roles in the development and management of such studies.

Two additional types of programs for health professionals were identified by the Task Force to increase further the pool of research-oriented individuals available in these areas:

Master's degree-level programs of study in epidemiology, biostatistics, or related topics. Training would provide individuals opportunity to assume other important roles in epidemiologic studies and clinical trials. The didactic course work would be similar to that for advanced programs of study, but the practical experience provided would be less intensive.

Nondegree, certificate programs of approximately one-year duration (or equivalent) with an emphasis on epidemiology and biostatistics. At least 50 percent of an individual's effort would be in didactic course work. Rotation through epidemiologic

studies or clinical trials in different stages of development, observation in coordinating centers and other central study facilities, and extensive participation as an observer at clinical study meetings, such as Data and Safety Monitoring Committee meetings, would be included as practical training. Individuals completing such a program would be expected to participate more effectively in clinical studies.

Support for these programs would be provided through existing NRSA institutional and individual NRSA mechanisms as well as K-series awards developed for this purpose.

2. Predoctoral Individual Fellowships

The NIH abandoned the general programs of individual predoctoral fellowships when the NRSA was enacted because of the relatively large staff required for their review and administration and the difficulty of evaluating applicants so early in their careers. However, individual predoctoral fellowships currently are being used effectively by the Alcohol, Drug Abuse, and Mental Health Administration (ADAMHA), the National Center for Nursing Research, and the Minority Access to Research Careers (MARC) program.

The Task Force on Predoctoral and Postdoctoral Training of Nonphysician Scientists pointed out that awards under this mechanism can complement training grants. Such awards would allow access to predoctoral training support in institutions that are too small to justify a research training grant and in research areas that have not yet grown to a size that can support such training grants. Individual fellowships also allow students the greatest flexibility in choosing the training program best suited to them and in which they will feel most comfortable. The potential use of these fellowships to address specific NIH training needs should be reviewed.

3. Research Training in New Subject Areas

The establishment of new research training programs will vary according to the mission of each BID. The Task Force on Predoctoral and Postdoctoral Training of Nonphysician Scientists identified the need for NIH periodically to review training areas currently supported and to determine whether new areas need to be created or old areas eliminated. For example, there may be a need for more nonphysician researchers with training in human physiology and pathology. Therefore, a process should be put in place to evaluate the need for research training in underserved areas of biomedical and behavioral research as well as the need for new approaches in the use of existing mechanisms of support for training programs.

RECOMMENDATION

Advanced programs of study in epidemiology, biostatistics, or related topics should be supported to increase predoctoral and postdoctoral research training opportunities. K-series awards should be developed to expand research career development programs for these individuals.

Current NIH mechanisms also should be used to support master's degree- level programs of study in epidemiology, biostatistics, or related topics and nondegree certificate programs with an emphasis on epidemiology and biostatistics.

The opportunity for individual predoctoral fellowships to address specific NIH training needs should be reviewed.

An ongoing process should be instituted for evaluation of new research areas, approaches, and needs for NIH research training programs.

E. Trainee Stipends and Cost of Education

1. Trainee Stipends

Implementation of the new physician scientist research training concept will provide for training of individuals with a greater commitment to research. This is due to the minimum two-year requirement for research training, greater responsibilities on the part of the training directors and institutions, and more rigorous criteria for NIH review of new and competing renewals of training grant applications.

Fewer individuals may enter research training programs under the revised concept, but a greater percentage are expected to remain in research. The issue of whether stipend levels should be increased was discussed. An analysis of annual stipend levels for trainees was prepared and the current NRSA stipends and K-series award salaries as well as Association of American Medical Colleges (AAMC) data on housestaff salaries were examined. Stipend structures proposed by Task Force members and representatives of the scientific community were also considered. Concern was expressed that no increase in the stipend level is an important determinant in whether an individual remains on a training grant for a third year of training.

A proposed revision of trainee stipends was developed that would make trainee stipends comparable to current housestaff salary levels. It provides that individuals in the first postgraduate year (with zero years of experience) on a T award would receive a stipend of $25,000, which is essentially equal to the average salary for the first postgraduate (intern) year. Additionally, the structure assures that an individual is never required to accept a reduction in remuneration to pursue research training. The proposal, along with data on existing NRSA stipends and

K-series award salaries, is shown in Table 1 and Figure 5. Examples of how training stipends would be integrated with clinical salaries are presented in Figure 6.

The Task Force on Predoctoral and Postdoctoral Training of Nonphysician Scientists also recognized the need to increase both predoctoral and postdoctoral stipends. Its members emphasized that the agencies that support research training in the biomedical sciences, i.e., NIH, ADAMHA, and the National Science Foundation (NSF) should explore means of making the support mechanism more equivalent in terms of stipend levels, cost of education, and other trainee expenses.

2. Cost of Education

The general findings of relevant earlier reports of the NIH Committee on Payment of Tuition for Research Training Grants and the Subcommittee on Training Stipends of the Extramural Program Management Committee (EPMC) were reaffirmed by the Task Force on Predoctoral and Postdoctoral Training of Nonphysician Scientists. The institutional research training grant programs continue to play a crucial role in graduate education and in the research training of biomedical scientists. It is appropriate that the budgets for these awards include some support for the cost of education. However, it should be noted that, as grants-in-aid, these NIH awards are not obliged to pay full costs. The past two decades have seen constantly rising tuition charges, a declining NIH research training budget in real dollars (except for occasional stipend increases), and, consequently, sharp reductions in the number of predoctoral trainees supported. Many of the NIH Institutes

Table 1
Trainee Annual Stipend Levels

Current NRSA Stipends & K-Award Salary Levels

T Award								
Predoctoral 8,500								
Postdoctoral								
Years of Experience*	0	1	2	3	4	5	6	7
	17,000	18,000	25,000	26,250	27,500	28,750	30,000	31,500
K Award	≤ 40,000							

Mean Housestaff Salaries: AAMC Data

Postgraduate Years**	PG 1	PG 2	PG 3	PG 4	PG 5	PG 6
1988 - 1989 Salaries	23,382	24,813	26,141	27,421	28,699	30,129
1989 - 1990 Salaries	24,288	25,792	27,189	28,537	29,861	31,128

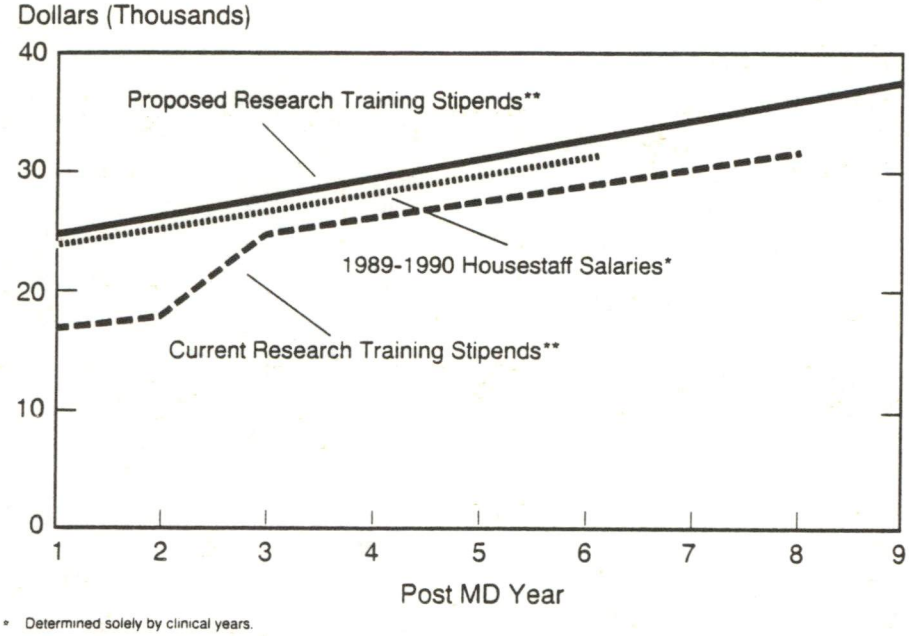
Proposed NRSA Stipends & K-Award Salary Levels

T Award									
Predoctoral 10,000									
Postdoctoral									
Years of Experience*	0	1	2	3	4	5	6	7	8
	25,000	26,500	28,000	29,500	31,000	32,500	34,000	35,500	37,000
K Award				≤ 50,000	≤ 50,000	≤ 50,000	≤ 50,000	≤ 50,000	≤ 50,000

* An individual with zero years of experience is in the first postgraduate year.
** An individual in the first postgraduate year has zero years of experience.

Figure 5

Housestaff Salaries and Research Training Stipends



* Determined solely by clinical years.
** Determined by all related experience.

Figure 6a

Clinical Salaries and Research Stipends Track I -- Two Year Option & Current ABIM Investigator Track Requirements

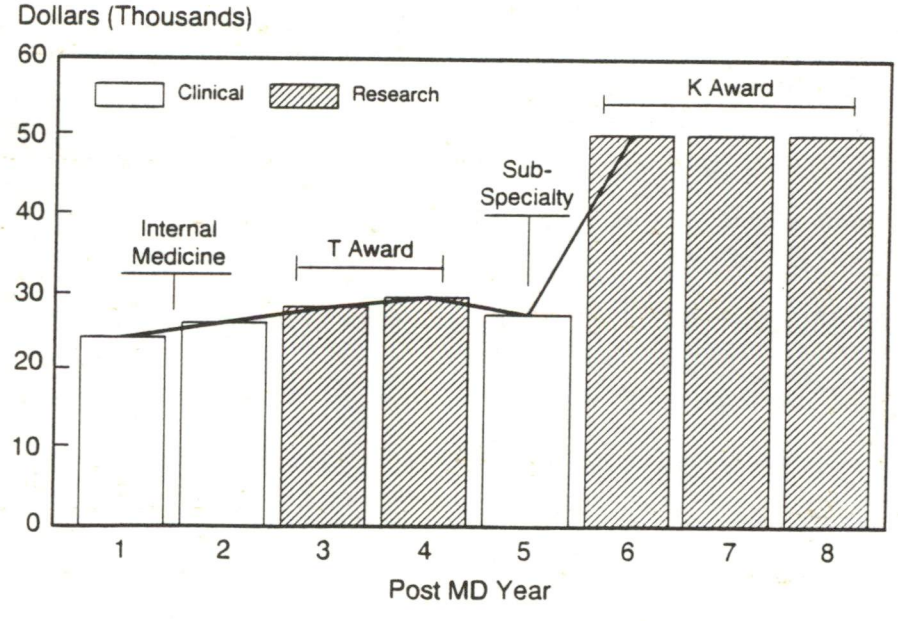


Figure 6b

Clinical Salaries and Research Stipends
Track II -- Three Year Option & Current
ABIM Investigator Track Requirements

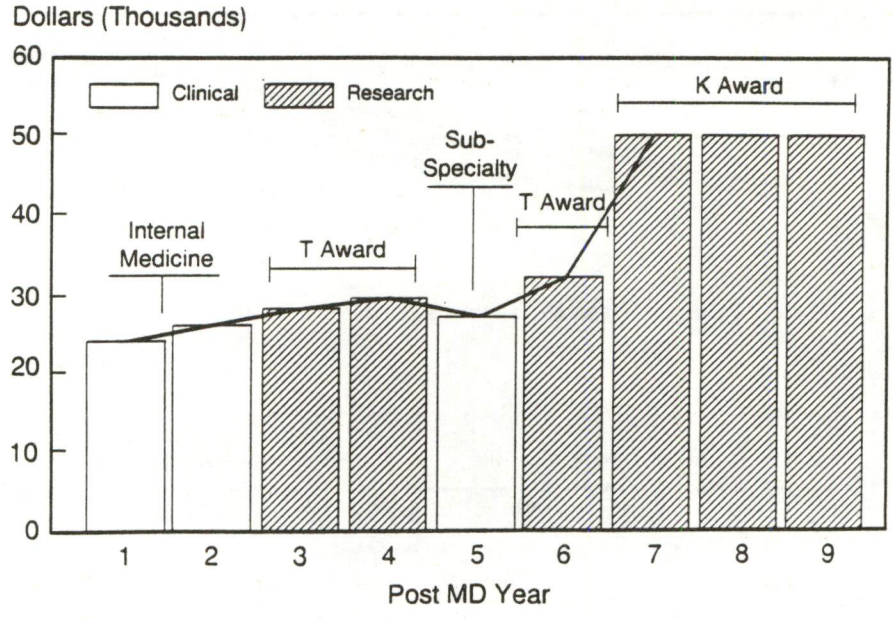
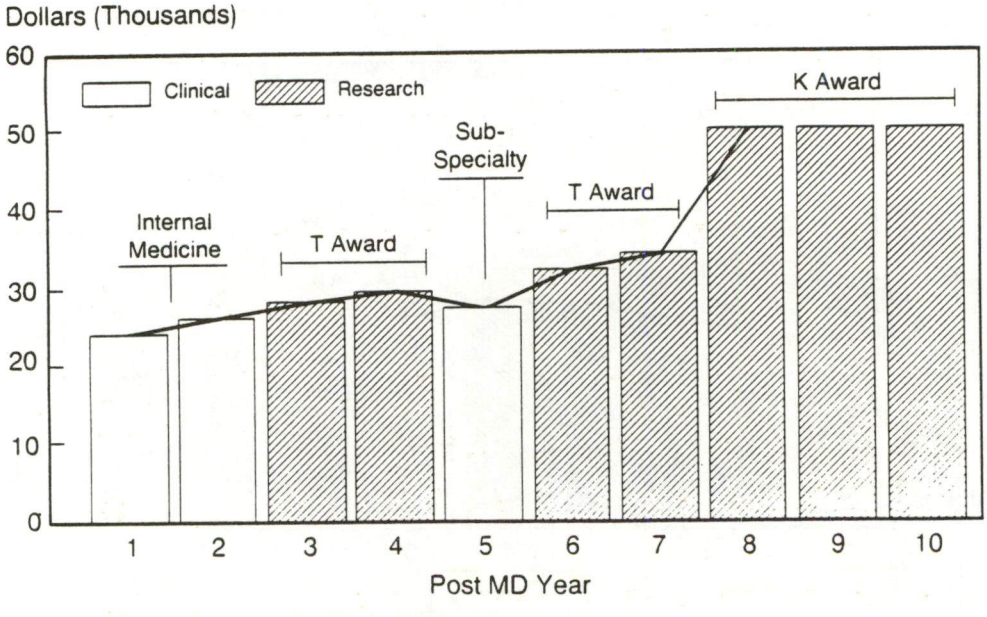


Figure 6c

Clinical Salaries and Research Stipends
Track III -- Four Year Option & Current
ABIM Investigator Track Requirements



periodically have frozen allowances for tuition to prevent an even greater decrease in the number of trainees.

The NIH Committee on Payment of Tuition for Research Training Grants proposed that NIH adopt a "two-tier cost of education (CoE) allowance" as a mechanism to control the fraction of the training budget designated for the CoE. It was reaffirmed that this mechanism seems to be the most practical and provides one CoE for predoctoral trainees at public institutions and another for those at private institutions.

Several other issues need to be taken into consideration in setting the yearly CoE allowance, the most important being the maintenance of *at least* a constant number of NIH-supported trainees. Annual increases in the research training budget would be requested in order to permit appropriate increases in the CoE allowance. Furthermore, although tuition is usually paid only for postdoctoral trainees who are enrolled in degree-granting programs, tuition payments for approved courses can be provided on a case-by-case basis. However, such payments should not exceed the predoctoral CoE allowance.

RECOMMENDATION

Levels of postdoctoral trainee stipends for professional doctorates should be increased to make them at least as attractive as current housestaff salaries. Levels of trainee stipends for predoctoral and postdoctoral nonphysician scientists should be increased each year, as needed, to compensate for the increase in the cost of living.

Those agencies of the Federal Government that support biomedical research training should explore ways of making the mechanism of support more equivalent in terms of stipend levels, cost of education, and other trainee expenses.

The proposal for NIH to adopt the "two-tier cost of education allowance" as a mechanism to limit tuition payments is reaffirmed. The CoE allowance for special NIH research training programs, such as the Medical Scientist Training Program (MSTP), should follow the same general principles.

F. K-Series Awards

Consistent with the overall five-year training concept, it was recognized that, after the minimum two-year research training experience on a training grant, a trainee would have the option to apply for an individual fellowship grant (F32), K-series award, FIRST award (R29), or a research project grant (R01) as illustrated in Figure 4.

The need was identified to modify the K-series awards to permit less than the current five-year duration. It was agreed that individuals may not need five more years for career development after completing the

minimum two years on a training grant. Therefore, a three-year award should be made available.

Summaries of several NIH K-series awards were reviewed. Presently, the NINDS offers the option of a three- or five-year K-series award, i.e., Clinical Investigator Development Award (K08).

The Task Force on Physician Scientist Training believes that three-year K-series awards are an important part of the revised training concept for physician scientists. It also believes that the salary support on an award received through a national competition (e.g., K-series award) after one or two years on a training grant should be higher, thus providing an incentive to compete for such an award. Salary levels for K-series awards were considered and members agreed that they should be integrated progressively with the stipend levels recommended for trainees on training grants (Table 1 and Figure 6).

RECOMMENDATION

Three-year K-series awards should be made available NIH-wide for professional doctorates. Salary levels for these awards should be increased to $50,000 annually.

G. Data Collection, Monitoring, and Evaluation

1. Data Analysis

The success of past and current training endeavors designed to provide scientists for biomedical research should be assessed. A large body of data exists that must be analyzed appropriately. Although the Committee on National Needs for Biomedical and Behavioral Research Personnel of the Institute of Medicine/National Academy of Sciences has collected and analyzed some of the data, particularly in regard to the overall opportunities for research training, more must be done. The Task Force on Predoctoral and Postdoctoral Training of Nonphysician Scientists emphasized the need for analysis of available data and for development of an ongoing process of data collection on all predoctoral and postdoctoral trainees and fellows, including the MSTP. This process is particularly important to the revised training program structure. Some of the items needed for evaluating programs are:

The numbers of Ph.D. and M.D. degree holders and predoctoral students supported each year. The numbers supported by institutional awards and individual awards should be recorded separately.

For each NRSA recipient, the length of NIH-supported research training, as well as additional training support mechanisms used by Federal agencies, the pharmaceutical industry, the Department of Veterans' Affairs, the Howard Hughes Medical Institute, and foundations.

The time lag between completion of research training and the subsequent submission of requests for research support.

The types of grant applications submitted.

The research grant application and award histories of former trainees and fellows in addition to information on their subsequent scholarly research pursuits.

2. New Databases

Because other data are necessary to evaluate research training activities in a meaningful way, each BID should work to develop and maintain its own database on training programs. Many items of importance appear in competing continuation applications. Of particular interest are the number of, and information regarding, underrepresented minorities and women:

Appointed to research training grants.

Supported by other research training and career development mechanisms and by the Minority Biomedical Research Support (MBRS) program.

3. Available Resources

The NIH has a number of resources available for analysis and assessment of the many aspects of research training. By using these resources more fully and continuously, collection of data can be greatly improved. Information is available in various files and documents including the payback file, the doctorate record file, the consolidated grant applicant file, and the trainee/fellow file.

It was recognized that a burden will be imposed on the NIH staff, collectively and at a programmatic level, by enhanced data monitoring and evaluation. In order to perform a careful analysis of the NIH research training programs, priorities will have to be set regarding the importance of each of these data files and how much information can and should be collected. It must be stated, however, that such data are essential if a thorough and critical analysis and evaluation of research training programs is to be performed. Evaluation funds should be considered for these studies.

RECOMMENDATION

A continuing process of data collection should be developed to capture information about all predoctoral and postdoctoral research trainees and fellows, including MSTP students, and their subsequent scholarly research accomplishments. A set of standards for data collection should be developed to ensure that information is uniformly recorded and can be compared across NIH. The need for new databases should be an important ongoing consideration in this process.

Available NIH training data should be analyzed further. The NIH should provide support, either directly or through contractual arrangements, to capture data from existing NIH files into a central file so that the information is readily available for evaluation studies. It is further recommended that consideration be given to using the one percent set-aside evaluation funds for these tasks.

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