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of the

CONFERENCE ON POSTDOCTORAL FELLOWSHIPS

and

RESEARCH ASSOCIATESHIPS IN THE SCIENCES AND ENGINEERING

Mt. Hope Farm Conference Center
Williamstown, Massachusetts
September 10-12, 1967

Office of Scientific Personnel
National Research Council
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INTRODUCTION

Two lines of concern and inquiry converged in the Conference on Postdoctoral Fellowships and Research Associateships in the Sciences and Engineering. One was represented by the Study of Postdoctoral Education in the United States, a two-year project currently being carried on within the National Research Council. The other derived from the responsibility of the National Research Council for the administration of a number of postdoctoral research associateship and fellowship programs and for conducting the evaluation of applications in still other nationally competitive programs.

The Study has a broad concern for postdoctoral education in all of its aspects and in all disciplines. At the time of the Conference, it had reached the half-way point in its collection and analysis of information about postdoctoral appointees and their sponsors, about institutional practices, and about the costs and benefits of postdoctoral education. The Conference offered a good opportunity to discuss early findings, resolve some ambiguities of definition and data collection, and look intensively at several important mechanisms for the support of postdoctorals -- the national fellowship and the national research associateship. Although the locally appointed postdoctoral research associate, supported by contract funds, would not be singled out for discussion under the limiting rubric chosen, it was clear that he would not and could not be forgotten.

A sharper concern arose from the participation of the National Research Council in the actual administration of postdoctoral fellowship and associateship programs -- participation that goes back almost fifty years to the days of the prestigious National Research Fellowship Program. The staff of the Office of Scientific Personnel, the National Research Council office within which most of these administrative services are provided, continuously reviews the operation of its programs -- by site visits, by discussion with evaluation panels, and by discussion with members of the staffs of the sponsoring agencies. Nevertheless, worries remain -- the extent to which the selection process continues to be valid in a time of rapidly changing academic interests and practices, the shrinking of support in some of the Federal fellowship programs at a time when the demand for postdoctoral research opportunities is steadily increasing, the largely undefined responsibilities of the host institution and the sponsoring organization toward the postdoctoral, and the rationale for the independent existence of support mechanisms which, by their operational characteristics, are becoming indistinguishable from each other. It seemed timely to present these issues to a nationally representative group and seek their advice.

Twenty-nine persons, representing universities, government agencies, the Study of Postdoctoral Education, NRC Divisions and study groups within the NRC, and the Office of Scientific Personnel conferred in the pleasant surroundings of Mt. Hope Farm Conference Center in Williamstown, Massachusetts, on September 10-12, 1967, and provided much helpful information and advice to

the Study of Postdoctoral Education and the Office of Scientific Personnel. The discussion was wide-ranging by intent. The participants did not hesitate to depart from the formal agenda and take up aspects of postdoctoral education that did not strictly come under the title of the Conference.

Definitions were a problem. "Fellow," "research associate," "education," "research," "training" -- these and other terms are being used in different senses by the universities, the agencies, and the postdoctorals themselves. The early discussion at the Conference borrowed some of this confusion. Perhaps it was one of the most useful results of the meeting that, near its end, having explained to each other what they meant by these words, the participants were beginning to use a common terminology to discuss the phenomenon of postdoctoral education.

This report contains a rather complete record of what was said and done at the Conference. The papers, which did much to open fruitful discussion, are given in extenso. Each group of papers is followed by portions of the discussion that took place during that session. Not all comments are reported, but enough of the discussion is recorded to give the reader some worthwhile insights, some valuable additional information, and an indication of agreement or disagreement among the participants. The summary statements of the discussion groups are given in their entirety. The report concludes with the results of a poll of opinion on fourteen key propositions, taken after the conferees had returned to their homes.

The only significant information that was available to the Conference members and not provided here was in a bulky set of documents -- referred to here as the "blue book" or the "source book" -- concerning some statistics of postdoctoral education. Copies of the source book can be obtained on a loan basis from the Office of Scientific Personnel by readers who wish to see it.

It is a pleasure to thank all of the participants in the Conference, and to give special thanks to those who presented papers or served as chairmen of sessions. We are also grateful to several of the agencies represented at the Conference for the support of travel by some of the participants. Finally, we warmly thank our colleague, Dr. Claude J. Lapp, who, as the official host at Mt. Hope Farm, made our stay so pleasant and provided every opportunity for a productive conference.

William C. Kelly, Director
Office of Scientific Personnel

November 26, 1967

BACKGROUND FOR THE CONFERENCE

Session I

Sunday evening, September 10, 1967

THE UNIVERSE OF POSTDOCTORAL EDUCATION

Richard B. Curtis

For a physicist to undertake social science research results in a certain amount of "cultural shock." Nothing, in retrospect, is quite so neat as mathematical physics where definitions, techniques and objectives are so carefully circumscribed that one feels that he knows what he is doing. In the social sciences the problems are much more slipperly with the result that there have developed two essentially different approaches. In the older mode a few general observations are used to undergird broad statements and arguments designed to explain cosmic activities of mankind. Perhaps one of the more advertised and recent works of this sort is Understanding Media by Marshall McLuhan. The other approach adopts a more positivistic attitude and demands that only operationally defined concepts be introduced. Since this results in the examination only of quantitative aspects of human behavior, the popular literature does not provide any examples unless one reads the Kinsey reports.

Anatole Rapoport, the mathematician from the University of Michigan, discussing this split within the political science community, says of the two groups that the former makes on a large scale grandiose statements that they cannot prove whereas the latter makes definitive declarations about trivia. In undertaking the Study of Postdoctoral Education the National Research Council and the Advisory Committee of the Study have determined to stand in both camps without becoming the captive of either of Rapoport's extremes.

I will not go into the problems of getting the Study started. You may read tnese details in the Source Book which was sent to you prior to the meeting. Instead of dealing with the mechanisms of collecting data let me stick to the assigned topic and attempt to draw the boundaries of the universe of postdoctoral education.

The title is the invention of Bill Kelly and is apt in that like the physical universe this one contains many different kinds of bodies. It is in fact this heterogenity which makes all statements about postdoctorals suspect. For example, some of you may have read the newspaper article to the effect that the Johns Hopkins University has some 850 postdoctorals, which is 1.5 times the number of faculty members there. In our census, however, of postdoctorals on tenure during the spring of 1967, Hopkins was able to locate only 255 who fit our definition. The major difference is that Hopkins considers all interns and residents in their Medical School and associated hospitals as postdoctorals, whereas the definition adopted by the NRC Study (Figure 1) excludes those people unless the prime purpose of their appointment is research training under the supervision of a senior mentor. Since our definition has been criticized as being too broad by some and as being too narrow by others, I feel that the Advisory Committee has probably done an excellent job.

FIGURE 1

DEFINITION OF A POSTDOCTORAL APPOINTMENT

This study is concerned with appointments of a temporary nature at the postdoctoral level which are intended to offer an opportunity for continued education and experience in research, usually, though not necessarily, under the supervision of a senior mentor. The appointee may have a research doctorate (e.g. Ph.D., Sc.D.) or a professional doctorate (e.g. M.D., D.V.M.) or other qualifications which are considered equivalent in the circumstances. A person may have more than one postdoctoral appointment during his career.

Since there is a wide variety of postdoctoral appointments, certain exclusions and inclusions are made for the purpose of this study.

EXCLUSIONS

1. Although appointments to Instructor and Assistant Professor are temporary, they are excluded because they are understood to be part of the regular series of academic appointments and lead, if all goes well, to a permanent position.
2. Visiting professor appointments are excluded if they fill regular places in the host institution's academic staff.
3. Service Research appointments which are not intended to provide an opportunity for continued education in research are excluded.
4. Internships and Residencies are excluded unless research training under supervision of a senior mentor is the prime purpose of the appointment.
5. Holders of a doctor's degree who are studying for another doctorate which does not involve research as a primary activity are excluded.

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Because of the variety of postdoctoral appointments, it is important to list some of the important inclusions for the purpose of this study.

INCLUSIONS

1. Postdoctoral appointments, supported by whatever funds, which provide an opportunity for continued education and experience in research are included.
2. Scholars on leave from other institutions are included if they come primarily to further their research experience.
3. Appointments of holders of professional doctoral degrees who are pursuing research experience are included even though they may be candidates for a second doctoral degree.
4. Appointments in government and industrial laboratories which resemble in their character and objectives postdoctoral appointments in the universities are included.
5. Persons holding fractional postdoctoral appointments are included. For example, a postdoctoral fellow with a part-time Assistant Professorship is included.
6. Appointments for a short duration are included if they are of sufficient duration to provide an opportunity for research and a formal appointment can be made.

Even within the Study definition, however, the variety of types of postdoctoral positions and of the people who take such positions is sufficiently broad to render somewhat meaningless statements about the entire roster of respondents. Nevertheless, let me begin with some general results. We have received almost 11,000 questionnaires from individual postdoctorals on tenure during the spring semester of 1967. We estimate from the comments of the coordinators of the Study appointed on each campus that there may be another 1,000 to 1,500 in the total population. Thus we are concerned with 12,000 to 12,500 postdoctorals in the United States including those U. S. citizens who are abroad. This includes postdoctorals not only in all fields of study and in a variety of types of institutions, but also at each level. Of the total sample some 47% are foreign citizens, although the figures vary widely by field and type of institution as well as by geographic region. Some of the complexity is shown in Figure 2.

The definition of the levels is a complex and not entirely satisfactory one. The very difficulty, however, is a consequence of the variety of motivations and kinds of postdoctorals. The "continuous" postdoctoral is easy to define. He is an individual who is currently on a postdoctoral appointment, who has had a previous postdoctoral appointment, and who, in fact, has had no more than one year at any other position other than as a postdoctoral since his doctorate. This is the perennial student and, fortunately, represents only 12% of the total group. These never-ending appointment probably should be eliminated, and I will not deal further with the continuous postdoctoral.

The dividing line between the immediate and the delayed postdoctoral is extremely fuzzy. Many of the fellowship programs as well as the CASE Phase II study define the junior postdoctoral as one within five years of his doctorate and the senior postdoctoral as one more than five years beyond his doctorate. Everyone agrees that the number 5 is arbitrary, but realizes that the decision must be made on some basis.

We have taken a slightly different tack and have introduced the ideas of "immediate" vs. "delayed" as a more meaningful distinction. The immediate postdoctoral is one who takes an appointment either immediately after his doctorate or before he becomes established in a semi-permanent position. The delayed postdoctoral has a semi-permanent position from which he takes a leave of absence and to which he intends to return. Such a distinction may be useful to those designing programs of support; programs designed for these two groups would mirror the motivations of the fellows. The delayed postdoctoral has made a career decision and seeks a fellowship to undertake activities defined and motivated by the needs of his current position. The immediate postdoctoral on the other hand is still relatively uncommitted to a particular career and must project at the time of his application a career context from which he can make plans. Both the host institution and the funding agency ought to design programs reflecting those differences.

Unfortunately these ideas have grown out of the results of the study and were not anticipated ahead of time. Consequently, the questionnaires were not especially designed to exploit these differences. Nevertheless, we

FIGURE 2

FOREIGN AND U. S. POSTDOCTORAL APPOINTEES

PERCENTAGES OF TOTAL POSTDOCTORAL POPULATION BY LEVEL AND INSTITUTION

	UNIVERSITY		GOVERNMENT		INDUSTRY		NON-PROFIT		OVERSEAS		TOTAL	
	U.S.	FOR	U.S.	FOR	U.S.	FOR	U.S.	FOR	U.S.	FOR	U.S.	FOR
Immediate	19.2	14.5	1.6	0.6	0.1	0.1	1.3	0.5	1.4		23.6	15.7
Continuous	3.3	7.1	0.2	0.4	0.08	0.03	0.3	0.5	0.3		4.1	8.0
Delayed	15.9	12.2	0.2	0.3	0.03	0.05	2.3	1.6	1.9	0.04	20.3	14.1
Total*	41.6	39.8	6.3	1.4	0.2	0.2	4.2	3.3	3.8	0.1	56.1	44.9

* Total is greater than sum of categories because individuals not in one of the categories above have been omitted.

have been able to show that for those postdoctorals who have not had a previous postdoctoral experience there is an essentially different response from those beyond that date (Figure 3).* This would suggest that rather than the five-year break now used, a two-year break would fit the situation better. The problem is somewhat different for those who have had a previous postdoctoral, but who escape being "continuous" postdoctorals. In this case, it is generally safe to consider them to be delayed independent of the number of years past the doctorate. We have taken them to be those with two or more years unaccounted for by postdoctoral appointments since the doctorate.

Once one makes the above distinctions among the types of postdoctorals it is then necessary to consider another degree of complexity. This is the mixing of Ph.D.'s and M.D.'s. Generally speaking, except for the basic medical sciences, these two types of doctorates are naturally separated when one considers the non-medical specialties apart from the medical specialties. However, Figure 4 gives the data on the distribution of these two doctoral types among the various host institutions. Two words of caution are necessary here. In the first place the data show no neat break as a function of years past the M.D. Nevertheless, the same definition was used as for Ph.D.'s. Also, at the time these data were compiled, only 9,786 questionnaires had been returned. Missing from the compilation are the large number of post-doctorals resident on the NIH campus in Bethesda. Consequently, the Government figures are distorted in this picture. By assuming all NIH postdoctorals are M.D.'s (which is not true) the total figures have been adjusted to take this into account.

Another way of slicing the postdoctoral pie is to consider the type of support. There was not time before this conference to examine the situation as a function of level, but the distribution among institution type can be seen in Figure 5. The percentages shown total 100%. Thus 38.5% of the respondents are fellows at universities, and 26.2% are research associates at universities. The only problem is that I frankly do not believe those figures. Were they trustworthy, we would be dealing with approximately 5,000 postdoctoral fellowships in the United States. However, NSF and NIH together are supporting only 1,300 fellows. Thus other agencies and private foundations would be supplying funds for the other 3700. We are attempting to gather data from all known agencies, foundations, health organizations and professional societies who have postdoctoral fellowship programs. Although the results are not all in, it is likely that there are no more than 3,700 fellowships from all sources. Approximately 1,300 postdoctorals, therefore, are calling themselves fellows who have not received their appointments through a national competition.

It is likely, but obviously not proven, that these misnamed individuals are really appointed under research grants. It is also reasonable to assume that it is at the university where this mischief is predominant for reasons I will give later. Let us assume that 1,300 of those who claimed fellowship support at universities are paid from project funds; Figure 6 shows the new

*In the figures 3A to 3E, the solid curves and the dashed curves represent different plots on the same graph. There is no necessary relation between them.

FIGURE 3

A. LEVEL DETERMINATION: LEAVE STATUS

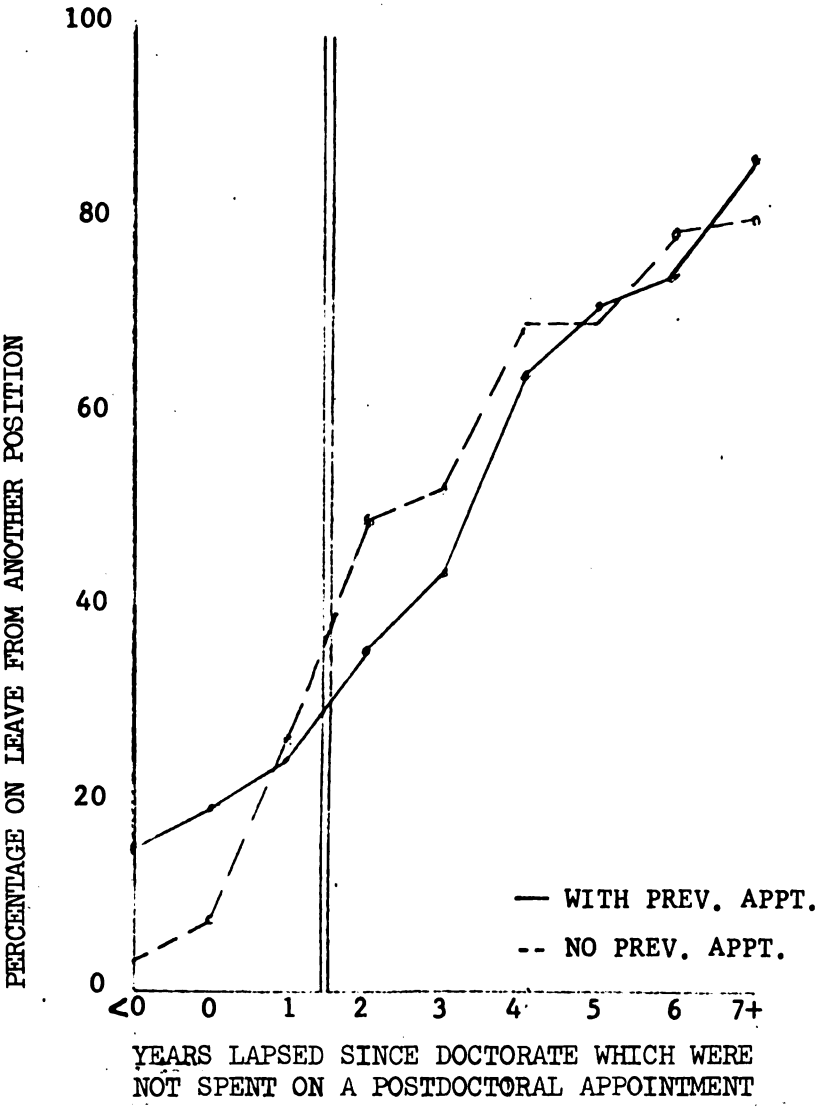


FIGURE 3

B. LEVEL DETERMINATION: NON-PROFIT SUPPORT & AGE

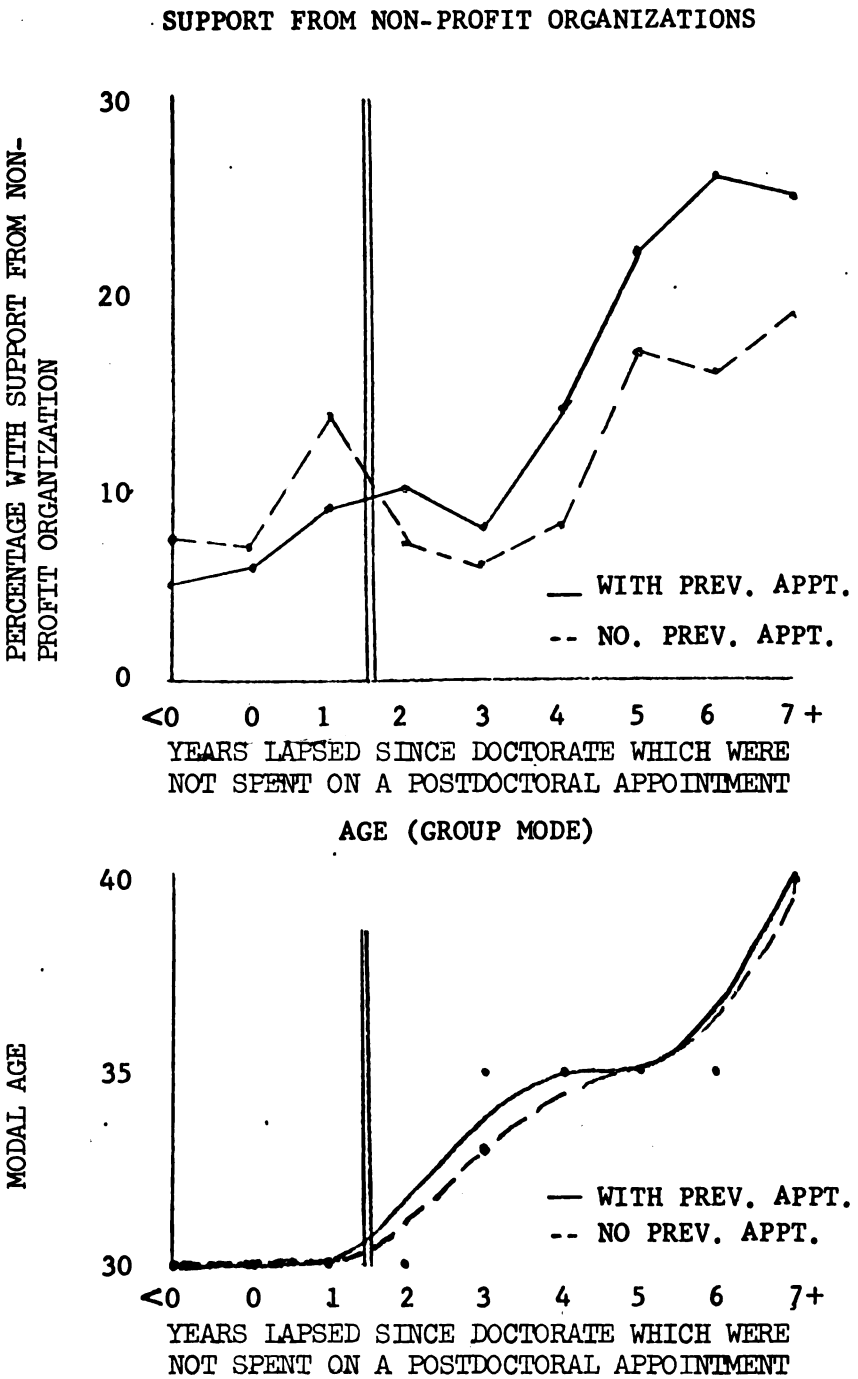


FIGURE 3

C. LEVEL DETERMINATION: STIPEND

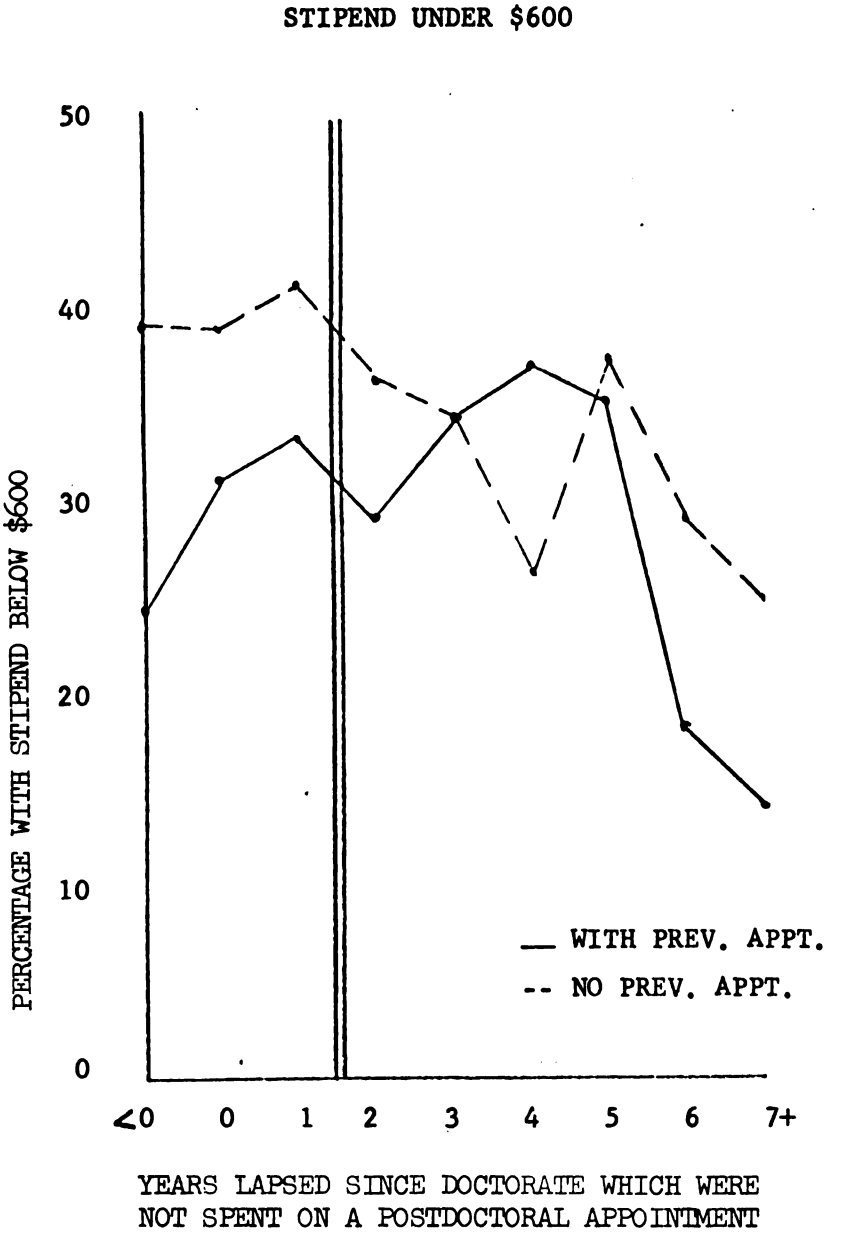


FIGURE 3

D. LEVEL DETERMINATION: CITIZENSHIP

U. S. CITIZENS

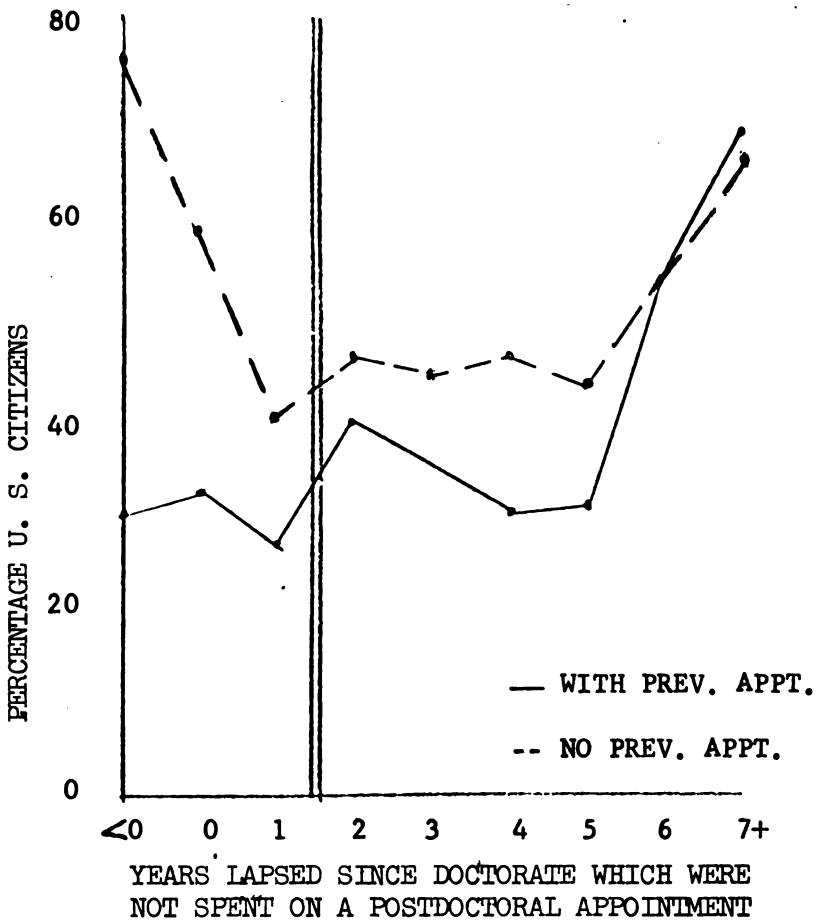


FIGURE 3

E. LEVEL DETERMINATION: FIELD

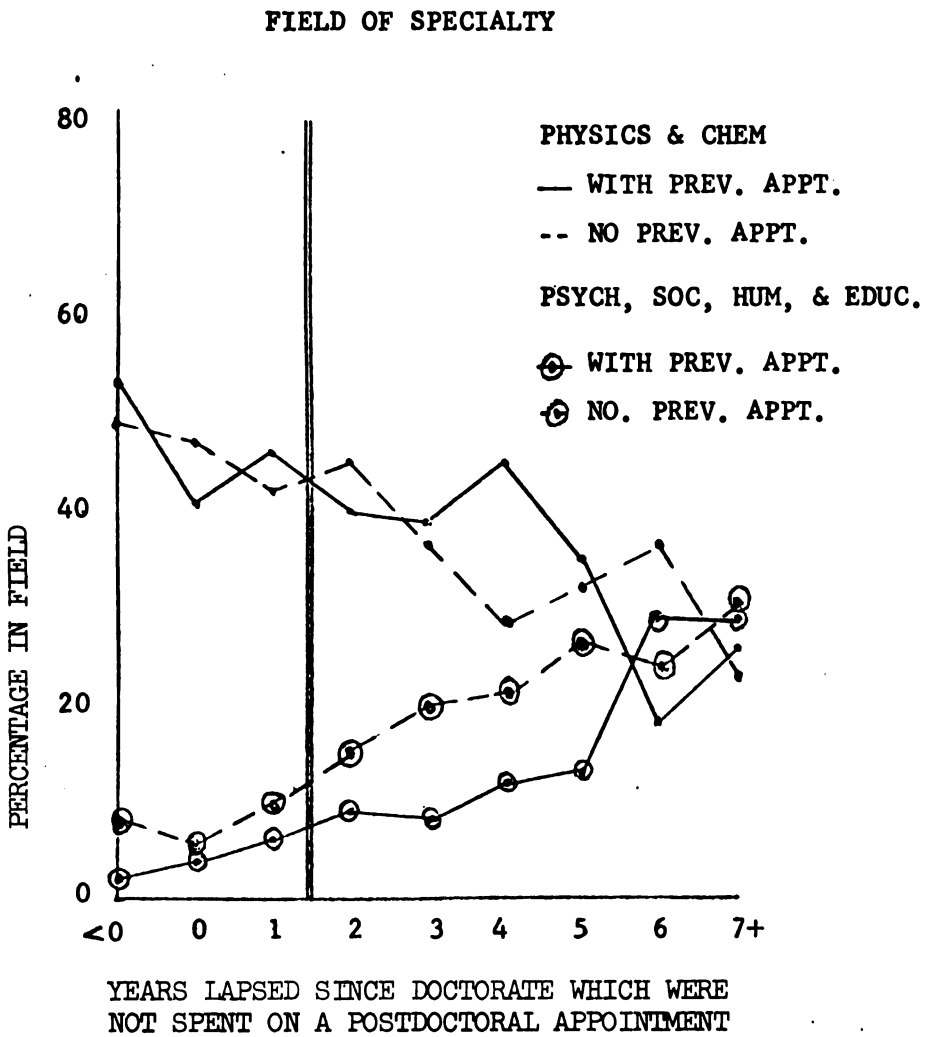


FIGURE 4

PH.D. AND M.D. POSTDOCTORAL APPOINTEES

PERCENTAGES OF TOTAL POSTDOCTORAL POPULATION BY LEVEL AND INSTITUTION

	UNIVERSITY		GOVERNMENT		INDUSTRY		NON-PROFIT		OVERSEAS		TOTAL	
	PhD	MD	PhD	MD	PhD	MD	PhD	MD	PhD	MD	PhD	MD
Immediate	32.2	3.5	2.3		0.2		1.5	0.4	1.4	0.03	37.6	4.0
Continuous	10.0	0.9	0.6		0.1		0.7	0.2	0.3	0.02	11.7	1.1
Delayed	11.0	19.0	0.5	0.04	0.09		0.9	3.2	1.60	0.4	14.0	22.3
Total *	55.7	24.6	3.5	4.4	0.5		3.3	4.1	3.4	0.5	66.4	33.6

* Total is greater than sum of categories because individuals not in one of the categories above have been omitted.

FIGURE 5

TYPE OF SUPPORT OF POSTDOCTORAL APPOINTEES

PERCENTAGES OF TOTAL POSTDOCTORAL POPULATION BY INSTITUTION (UNCORRECTED)

	UNIVERSITY	GOVERNMENT	INDUSTRY	NON-PROFIT	OVERSEAS
FELLOWSHIP	38.5	1.9	0.05	5.3	2.8
TRAINEESHIP	8.3	0.07	0.00	1.0	0.03
PROJECT FUNDS	26.2	1.3	0.07	0.7	0.07
OTHER	7.6	4.4	0.3	0.5	1.1

FIGURE 6

TYPE OF SUPPORT OF POSTDOCTORAL APPOINTEES

PERCENTAGES OF TOTAL POSTDOCTORAL POPULATION BY INSTITUTION (CORRECTED)

	UNIVERSITY	GOVERNMENT	INDUSTRY	NON-PROFIT	OVERSEAS
FELLOWSHIP	25.8	1.9	0.05	5.3	2.8
TRAINEESHIP	8.3	0.07	0.00	1.0	0.03
PROJECT FUNDS	38.9	1.3	0.07	0.7	0.07
OTHER	7.6	4.4	0.3	0.5	1.1

distribution. I think that most of us from universities would feel more at home with these figures. We will be able to be more definite about this manipulation of the data when the returns from our departmental questionnaire are analysed.

Nevertheless, it is useful to speculate on the reasons for those misleading returns. At first one is tempted to say "what's in a name?" However, the Internal Revenue Service treats fellows quite differently from research associates. (Perhaps they should not since the activities of each type may be extremely similar; this we will want to investigate further.) The data suggest that some institutions and some postdoctorals are not familiar enough with this distinction.

It would not be fair, however, to attribute the effect solely to a desire to avoid taxes. In the past, there has been little distinction made by those who have attempted to measure anything about the postdoctoral phenomenon. The Doctoral Records File of the National Research Council, for example, asks the recent doctorate about his prospects and arrangements for his professional future. The only option offered that would apply to the postdoctoral of whatever stripe is "Have postdoctoral fellowship, sabbatical leave, or equivalent arrangement." The young man who has accepted an appointment as a reseach associate is forced to check that alternative.

Beyond such considerations, however, is the practice in some schools and departments of using the phrase "research fellow" to distinguish the postdoctoral from the "research associate" who at these institutions is a full time semi-permanent employee at the master's-degree level. I have noticed this terminology in use at some universities in biology departments, and Figure 7 gives some credence to the idea.

Finally the postdoctoral population can be examined by field. If we examine Figure 8 the extremely uneven distribution becomes evident. One of the questions which I hope will be explored in detail at this conference is that of the balance between fields in relation to the nation's manpower requirements. The present system of many uncoordinated programs providing support for postdoctoral education has meant that some fields are overpopulated and others are going begging for support. The situation is aggravated by the tendency of distributing awards and positions either in terms of the number of applications or in proportion to the level of support of the field in the previous fiscal year. This reliance on the status quo as the guide to future activities is certainly the easier approach, but not necessarily the most responsible. I believe that the time is upon us when tough decisions need to be made.

This situation is illustrated even more dramatically in Figure 9. Here we have the situation with regard to physicists in universities. I will let you draw your own conclusions on whether the existing pattern has flaws which ought to be corrected.

In conclusion let me make a few comments on the pattern of postdoctoral education and on the problems which face us at this conference. As the various statistics presented here illustrate, the postdoctoral population is extremely

FIGURE 7

TYPE OF SUPPORT OF POSTDOCTORAL APPOINTEES AT FIVE INSTITUTIONS IN THREE FIELDS

NUMBERS OF APPOINTEES

	FELLOWSHIP	TRAINEESHIP	PROJECT FUND	OTHER
MIT				
Physics	3	0	13	4
Chemistry	12	1	55	2
Biology	36	6	35	4
PRINCETON				
Physics	8	0	26	2
Chemistry	4	0	11	3
Biology	10	1	8	0
INDIANA				
Physics	2	0	9	0
Chemistry	9	0	4	0
Biology	11	1	14	2
STANFORD				
Physics	4	1	40	4
Chemistry	13	4	15	4
Biology	37	12	9	4
U C L A				
Physics	4	0	14	2
Chemistry	22	1	12	1
Biology	22	16	31	4

FIGURE 8

FIELD OF POSTDOCTORAL APPOINTEES BY TYPE OF INSTITUTION

PERCENTAGES OF TOTAL POSTDOCTORAL POPULATION

	UNIV	GOVT	INDUSTRY	NON-PROFIT	OVERSEAS	TOTAL
MATHEMATICS	1.7	0.07	0.02	0.7	0.2	2.6
PHYSICS & ASTRONOMY	10.5	1.4	0.2	0.4	0.5	13.1
CHEMISTRY	14.2	0.5	0.08	0.4	0.4	15.5
EARTH SCIENCES	1.3	0.3	0.01	0.06	0.1	1.8
ENGINEERING	2.3	0.1	0.01	0.03	0.1	2.5
AGRIC. & BIO-SCIENCES	26.0	0.9	0.05	1.8	1.5	30.0
PSYCHOLOGY	1.6	0.07	0.04	0.4	0.2	2.3
SOCIAL SCIENCES	1.9	0.03	0.00	0.3	0.3	2.4
ARTS, HUMANITIES & PROF.	1.5	0.03	0.00	0.1	0.2	1.9
EDUCATION	0.4	0.00	0.00	0.05	0.00	0.4
MEDICINE	17.5	4.2	0.00	3.3	0.4	25.5
OTHER OR UNKNOWN	1.6	0.00	0.00	0.00	0.00	1.6
TOTAL	80.5	7.6	0.4	7.5	3.9	100.0

FIGURE 9

DISTRIBUTION OF POSTDOCTORAL APPOINTEES IN PHYSICS

NUMBERS OF PHYSICS POSTDOCTORALS

	UNIVERSITY		GOVERNMENT		INDUSTRY		NON-PROFIT		OVERSEAS	TOTAL*	
	US	FOR	US	FOR	US	FOR	US	FOR	US	US	FOR
IMMEDIATE	352	255	62	25	7	5	10	9	15	446	294
DELAYED	29	67	4	10	1	3	1	3	26	61	83
CONTINUOUS	71	131	9	15	5	2	0	4	5	90	152
TOTAL*	500	568	80	63	13	10	16	22	53	661	664

* Totals contain unknowns and no degree

AT UNIVERSITIES:

Field	No	Field	No	Field	No
Atomic & Molecular Physics	92	Fluids	29	Nuclear Structure	172
Electromagnetism	27	Optics	7	Solid State	267
Acoustics	7	Thermal Physics	22	Physics, General	9
Mechanics	2	Elementary Particles	232	Physics, Other	96

OTHER FACTS:

Postdoctorals are at 103 universities.

50% of all postdoctorals at 13 universities.

27% of all postdoctorals at 5 universities in California and Illinois.

2.9% of faculty sponsors have 12.5% of postdoctorals.

mixed. It will only add to the confusion if the suggestions and comments we make are not related rather specifically to the relevant component of the population. Few valid conclusions can be made about the population as a whole.

The other comment is with regard to the place of fellowships and nationally competitive research associateships with which the next two speakers will deal. There is evidence that, in spite of the difference in intent between these national programs and the support of a large, locally chosen population of research associates by project funds, this difference is little perceived by the postdoctorals themselves. The fellow, it is true, can choose his institution whereas the research associate must go where the project is. However, once begun the activities of the two types, when both are immediate postdoctorals, are essentially undifferentiated. Consequently, our discussion of the distribution of fellows among fields ought not to ignore the pattern of research support already established by other officesin the Federal establishment.

I am grateful that all of you have come to Mount Hope Farm to share in this discussion. I anticipate learning much and am confident that we shall come to some useful guidelines and conclusions.

SELECTING POSTDOCTORAL FELLOWS

W. C. Kelly

The National Research Fellowships

One of the first programs of fellowships in the United States was the National Research Fellowship Program, which set the pattern for selection in subsequent programs of this kind. It is worthwhile to take a few minutes to talk about how the National Research Fellowships got under way and what they accomplished.

Discussions that led to this premier program of fellowships began in 1918.[1] At the end of World War I, many people were convinced that science in the United States needed greater independence from European science and that measures to achieve this by the strengthening of basic research here should be taken. One of the first possibilities considered was the establishment of a Rockefeller Institute of Physics and Chemistry similar to the Rockefeller Institute of Medical Sciences. The Rockefeller Foundation and the National Research Council jointly discussed this possibility. It was pointed out, however, that several such institutes might be more effective than one because they would distribute this kind of stimulus more widely throughout the country. Further discussion produced the idea that the support of research by very able young scientists might accomplish as much as or even more than a series of institutes. As a result, it was proposed that a program of postdoctoral research fellowships in physics and chemistry be established under the auspices of the National Research Council and with the support of the Rockefeller Foundation. The fellows would be selected for unusual ability and for promise of future leadership in scientific research. They would do postdoctoral research at universities, bringing to the universities the stimulus of their ideas and obtaining from the universities further training in research.

The Council of the National Academy of Sciences gave approval to this plan on March 11, 1919, and on April 4, 1919, the Rockefeller Foundation took favorable action on a request for funds from the Research Council. The Foundation set aside $500,000 for five years to support a fellowship program of this kind in physics and chemistry, to which other physical sciences were soon added. Other disciplines became interested in this program, and by 1923, the biological sciences and the medical sciences had established similar programs with support from the Rockefeller Foundation.

During the period 1923 to 1931, 18% of all new PhD's in the natural sciences applied in the National Research Fellowship Program, and 5% of them were given awards. In the medical sciences, comparisons are more difficult because some applicants held PhD's and some held M.D.'s. The number of applicants was 1.7% of the number of M.D.'s conferred from 1923 to 1931, and the number of awards was 0.4% of the number of M.D.'s. During the first 30 years of this program, 1,359 scientists received awards at a cost of $4.8 million to the Rockefeller Foundation. The success ratio -- the ratio of the number of awards made to the number of applications -- varied from about 50% during the late 1920's, to 11% in the early 1950's. Throughout the history of the program, the number of awardees never exceeded 5% of the number of doctorates.

[1] See Myron J. Rand, "The National Research Fellowships," Scientific Monthly 73, 71 (1951)

The first selection panel for the National Research Fellowships in physics and chemistry consisted of George E. Hale, R. A. Millikan, A. A. Noyes, W. D. Bancroft, H. A. Bumstead, E. P. Kohler, and C. E. Mendenhall. During 1919, the first year of the program, this panel picked 13 fellows from among 54 applicants. They set a high standard for selection because four of the first fellows subsequently became members of the National Academy of Sciences, and one of them became a Nobel-Prize winner. The selection panel reviewed application forms, letters of recommendation, university transcripts of grades, statements of professional goals, and plans of research. In this respect, the program was very similar to present programs. Later, the applications were screened first by Committees of the National Research Council Divisions before being handed to the Fellowship Board for their final review and decision. The bases for judgment by the Board were the strength of the application as shown by the documents submitted, the ratings of the screening committees, and the members' own estimates of the need for research scientists in the various fields.

The results of the National Research Fellowship Program are well known. The program was eminently successful in raising the status of science in the United States. Upon completion of their tenures, the former fellows joined educational institutions and industrial and governmental laboratories and carried with them their enthusiasm for research and their high competence. They made a major contribution -- perhaps the most important single contribution -- toward raising the status of the United States to one of real eminence in the sciences. The money and the effort involved in establishing this program and administering it paid off well indeed.

Selection in 1967

Let us look now at the selection problem in choosing fellowship awardees in 1967, almost half a century after fellowship programs began. This part of my talk will draw on the experience of the Fellowship Office of the National Research Council in conducting evaluations of applications in the National Science Foundation Senior and Regular Postdoctoral Fellowship Programs, the NATO Postdoctoral Fellowship Program, and the Postdoctoral Research Program of the Air Force Office of Scientific Research. However, although we shall refer to these particular programs, the procedures and problems in them are common to most postdoctoral fellowship programs.

Some Similarities

The present-day programs are similar to the National Research Fellowship Program in many ways. For one, the purpose is much the same. Here I quote from a brochure used to announce one of the National Science Foundation Postdoctoral Fellowship programs. These programs provide "opportunity for qualified individuals to supplement their training as scientists. These fellowships are not thought of as providing support for research projects as such. Specifically, they are intended to support individuals planning additional study or research with a view to (a) increasing their competence in their specialized fields of sciences, or (b) broadening their competence in related fields of science."

Secondly, we follow the tradition established earlier of having the applications evaluated by panels of truly distinguished scientists. The panels

meet for two days ordinarily to review these applications. They give the applications a very thorough reading, rate them, discuss the merits of the applicants who place high in this evaluation, and finally recommend to the National Science Foundation the order in which the applications should be ranked in selecting awardees.

The third point of similarity is that the documents considered nowadays are very much the same as those used earlier. We require the applicant to submit an application form with information about his education and his personal background; grade transcripts; a proposed plan of research; a statement of research experience, including a bibliography; and letters of reference. Some mechanization has been introduced into the application procedure in modern postdoctoral fellowship programs, such as a reference report form including a scale for indicating the overall judgment of the referee, but changes have been infrequent.

Finally, the success ratio in the present programs is about the same as that in the earlier programs. Currently, it runs about 12 to 15%.

Some Differences

Let us now consider some of the differences between the early program and the present-day programs. The first is that we have much larger numbers of applications to deal with. At the peak of the National Research Fellowship Program, 399 applications were reviewed in one year. The situation in several programs in Fiscal Years 1966 and 1967 is shown in Table 1.

TABLE 1

Numbers of Applications and Awards in
Four Postdoctoral Fellowship Programs

	FY 1966		FY 1967	
	Applications Applications	Awards Offered	Applications	Awards Offered
NSF (Regular) Postdoctoral	1070	230	1043	150
NSF Senior Postdoctoral	397	95	393	65
NATO Postdoctoral	395	66	384	45
Postdoctoral Research (AFOSR)	149	15	187	15

Corresponding to the larger number of applications is a larger number of panelists. For example, in the (Regular) Postdoctoral Fellowship Program this past year, 91 panel members evaluated the 1,043 applications.

The second point of difference is that there is a much greater degree of scientific specialization among the applications and the panel members. Panelists in the postdoctoral fellowship programs are less willing than formerly to read applications that are out of their fields. They are unwilling to judge applicants in other fields or to let panelists in other fields judge applicants in their own field. This means that it is necessary for the Fellowship Office to look carefully at the composition of the applicant group and to try to match it with the specializations of the panel members as closely as possible.

Thirdly, young scientists these days have other opportunities for support. The National Research Fellowship Program was unique in its day. Nowadays, there are many fellowship programs, there are research contracts that permit research associates to be appointed, and there are National Research Associateship programs of the kind that Dr. Boyce will describe shortly. Often the applicants in a fellowship program apply to several programs at the same time. Let me give you some data concerning the frequency with which this is done. In the NSF Senior Postdoctoral Fellowship Program in FY 1967, in 393 applications there were references to 340 applications being made in other programs, of which those most frequently named were the following: Guggenheim, 151; Fulbright-Hays, 42; NATO Postdoctoral, 36; NIH Special Postdoctoral, 30; Public Health Service, 26; Petroleum Research, 10; and Social Science Research Council, 8. In the NSF (Regular) Postdoctoral Fellowship Program in FY 1967, 809 additional applications were referred to in the 1,043 applications with the popularity count as follows: NIH Special Postdoctoral, 243; Public Health Service, 126; NATO Postdoctoral, 116; AFOSR, 70; NRC Postdoctoral Research Associateship, 49; Fulbright-Hays, 34; American Cancer Society, 30; Guggenheim, 23; American Association of University Women, 13; and Social Science Research Council, 12.

The fourth point of difference is that there is greater pressure these days to do postdoctoral research. In the early 1920's, postdoctoral research, under a special appointment, was an activity engaged in by only a relatively few, unusually able young scientists. Nowadays, not only do many of the very able engage in this activity, but it is becoming increasingly something that the average young PhD expects to do and is expected to do before he becomes established in a permanent position. For others, including senior investigators, postdoctoral research is something that is needed in order to keep up with rapidly advancing fields, and we therefore have the Senior Postdoctoral Fellowships, the Guggenheim Fellowships, and so on.

Some Current Problems

I turn now to some problems in connection with the selection of awardees in the fellowship programs with which the National Research Council has been associated. These remarks are based upon the discussion at meetings of panel chairmen, held at the end of each evaluation meeting. The panel chairmen assemble to discuss the final results and also to make suggestions for the improvement of the program. They point to problems in the selection process and comment on the quality of the applicant groups in their respective fields.

One of these problems is how to arrive at an equitable distribution of awards across fields among the applicants who have been judged to be the

most able. At present, recommendations for awards are usually made in proportion to the number of applications in each particular field of specialization. A field in which 10% of the eligible applications had been made, for example, might expect on this basis to receive about 10% of the recommended awards, including its top applicants. The question that comes up at this point is whether some other criterion might be involved, such as the "need" of a certain field for support, the readiness for a breakthrough in the field, and so on. Although these other possible bases have been discussed at meetings of the panel chairmen, the panelists have seldom been ready to accept anything other than the numbers of applications as the basis for distribution. They find great difficulty in assessing and quantifying "need" or "readiness" as a means of determining how many awards would be recommended in each field.

The second problem that I would like to direct your attention to -- this is a troublesome one indeed for the panelists -- is that of the one-year awards versus the two-year awards. Of 1,369 applicants in the fall and spring of FY 1965 and in the fall of FY 1966 in the (Regular) Postdoctoral Fellowship Program, 217 asked for more than 20 months of tenure. Moreover, requests for two-year tenures were more prevalent in the life sciences than in the physical sciences. Fifty-six per cent of the applicants who wanted more than 20 months of tenure were in the life and medical sciences whereas only twenty-eight per cent of the total applications were in those fields. Moreover, the percentage of the two-year applicants ranking high in the selection was larger in the life and medical sciences than in other fields. This reflects the custom in the life and medical science fields of engaging in postdoctoral study for at least two years; scientists in those fields are used to having available tenures of that kind. Applications in the EMP fields are predominantly for one year. This creates quite a problem for the panels because they must decide whether they will distribute the awards by numbers of individuals (tending to favor the life-science fields) or by number of fellowship-years (tending to favor the EMP fields). Arguments for each of these procedures are plausible, and some strain results.

The third problem is the sizable decrease in funds available for awards within these National Science Foundation programs during the last year. This increases the competitive spirit of the programs and, of course, increases the anxieties of the panels who must now deny support to many more promising young scientists and established investigators. Table 1, given earlier, indicates how severe this reduction has been. The reduction in the number of awards offered from FY 1966 to FY 1967 averaged about 30% in the (Regular) Postdoctoral Fellowship, the Senior Postdoctoral Fellowship, and the NATO Postdoctoral Fellowship programs. Of particular concern to the panelists -- and, of course, to the applicants -- is the fact that this cutback in the number of awards of postdoctoral fellowships accompanied cutbacks of research grants which affected the young Ph.D. group very much also. There has been a strong adverse reaction to this reduction within the academic community. Both the National Research Council and the National Science Foundation have received a number of telephone calls and letters pointing out the serious problem that results when these young Ph.D.'s, who have been trained to do research, are unable to obtain support to do it.

Next is the problem of applications by the older and more established persons and by persons who are primarily interested in teaching. There are

many meritorious individuals in both of these groups, but when they apply in the (Regular) Postdoctoral Fellowship Program, the panel members find it difficult to decide how to handle them. It is pertinent here to note that the National Science Foundation conducts a Science Faculty Fellowship Program which is intended for the "teachers"; however, they apply in these programs as well.

We also have a problem in matching the specialties of the panelists to those of the applicants. Fortunately, we are in a better position to do that these days because we now have a good roster of nominees for panel service. This roster was compiled with the assistance of department heads throughout the country, members of the National Research Council divisions, and members of the staff of the various divisions of the NRC. The continuing willingess of panel members to serve without pay, often at considerable cost in time, is a source of inspiration and encouragement to those who administer these programs.

Another problem involves improvements in the information base used in making the selection of awardees. How can we improve the quality of information obtained by means of reference reports? What can we do to keep the length of the research plan within reasonable limits without omitting essential information? How can we provide for the panel members information about foreign institutions at which applicants wish to study, but about which panel members may be uninformed?

We need to evaluate the effectiveness of the programs. The postdoctoral fellowship programs have been operating now in their present form for over ten years. We are confident that they are achieving good things, but it would be very desirable to know exactly what their effects have been, particularly in increasing the competence of young scientists and starting them on productive careers. The Study of Postdoctoral Education in the United States, which Dr. Curtis has reported on, will help greatly through follow-up studies of the careers of former fellows.

Another problem is that of providing information about the availability of the postdoctoral fellowship programs. This information needs to be more widely disseminated in certain fields; the social sciences furnish an example.

Concerning Quality

Now I would like to make what would seem to me to be a justified statement about the quality of the awardees. The panel members and their chairmen have found that the quality of the applicant groups in these programs in recent years have been, with few exceptions, sufficiently high to allow them to select an unusually able group of nominees for awards. A few fields have been occasionally disappointed in the quality of their applicants -- engineering, in which postdoctoral education is just beginning to be important, provides an example. In general, however, the quality is holding up well. Indeed, some panel chairmen maintain that the quality of these awardees seems higher, on the average, than that of those who receive research grants. "Borderline" status on the list of recommendees is the result of financial necessity and is far from being "borderline" in quality.

Some Issues for the Conference

In conclusion, let me suggest some issues that I believe deserve the attention of this conference. Any of the foregoing problems is worthy of discussion, but the following questions seem particularly important:

1. What is the place of the nationally competitive postdoctoral fellowship programs in the spectrum of support of advanced education in the sciences and engineering? Do they have a unique role to play, and if so, what is it and how can it be enhanced.

2. Are there some guidelines that would be helpful to the sponsoring organizations in setting an appropriate level of funding for these programs?

3. How can fellowship awards in these highly competitive programs be most fairly distributed among fields and have maximum effect in the strengthening of science and engineering? Is there any better basis than "application pressure" for doing this?

4. Is there a way out of the dilemma of one-year versus two-year awards?

SELECTING POSTDOCTORAL RESEARCH ASSOCIATES

J. C. Boyce

Since 1955, the Office of Scientific Personnel of the National Research Council has evaluated applications for Research Associateship positions in an increasing number of Federal laboratories. Administratively the programs fall into two categories.

A. Postdoctoral Research Associateship Programs

Postdoctoral Research Associateship Programs provide, within the Civil Service framework, temporary research positions in a number of laboratories. One-year appointments may be renewed for a second year, but no longer, when the Laboratory and the Associate find such a renewal to be of mutual advantage.

Table 1 shows for each currently participating organization and for years commencing with 1961, the number of completed applications, the number of applications approved by the panel, and the number of associates accepting initial appointments in the program in each year. Applications for the Weather Bureau (now ESSA) were first invited in FY 1965, for the David Taylor Model Basin (now Naval Ship Research and Development Center) in FY 1966, and for the Naval Ordnance Test Station (now Naval Weapons Center) in FY 1967.

During the past year new programs were approved for the U. S. Geological Survey and for the Naval Postgraduate School. Applications for appointment in these two programs will first be received in FY 1968.

B. Resident Research Associateship Programs

In the closely related Resident Research Associateship programs, NRC made appointments at the postdoctoral level (and in some cases at a senior postdoctoral level) for five other government agencies. These are the Army Natick Laboratory, National Aeronautics and Space Administration, Smithsonian Institution, Air Force Office of Aerospace Research, and Army Munitions Command. In these programs, the associates receive appointments and stipends through the National Research Council.

Table 2 shows the number of associates on tenure at the end of each of the last three fiscal years in each of these programs.

TABLE 2

RESIDENT RESEARCH ASSOCIATESHIP PROGRAMS

Associates on Tenure at End of Fiscal Year

	1965	1966	1967
Army Natick Laboratory	8	9	7
NASA	82	118	136
Smithsonian Institution	11	16	13
Air Force Office of Aerospace Research	--	--	3
Army Munitions Command	--	--	2

Arrangements were completed during the year to initiate in 1968 a similar program with the Army Materials and Mechanics Research Center.

Although the administrative differences are not relevant to the selection process, the older "Resident Research Associateship" programs, those at Natick and NASA and a part of the Smithsonian program, differ from the others (in both groups) in the way in which the selection is carried out. In these three cases, applications are evaluated as soon as they are received -- a continuous evaluation process. Copies of the application material are sent to three reviewers in the appropriate general field. The reviewers are asked to comment on the proposal and to recommend for or against the appointment. In the infrequent case of a division of opinions among the reviewers, a staff decision is made, usually after obtaining additional information or after telephone discussions with the reviewers.

In contrast, all of the programs listed in Table 1, the other part of the Smithsonian program, and the programs of the Air Force Office of Aerospace Research and the Army Munitions Command have an annual deadline. The applications are then considered as a group at a panel meeting in Washington. I personally believe that the panel meeting is a much more satisfactory way to handle the evaluation process. Some members of the conference group have served in one of these processes and some in the other. Dr. Borst has helped us in both types. Dr. Maurer is currently serving in the group which reviews NASA applications on a more or less continuous basis, but he also serves in fellowship panel meetings and can compare the methods.

One suggestion is under consideration as a substitute for continuous evaluation in which the reviewer sees the applications one or two at a time. That is to hold up the applications and send them in batches to the reviewers every two or three months. This might be a good compromise for the cases where the sponsors are reluctant to have an annual competition.

In addition to serving on the panel for the programs listed in Table 1, Dr. Lloyd Smith has carried out inspection trips to a number of the laboratories in that group and to some other laboratories which were candidates for admission to that group. He will tell you later of his experiences and of the criteria which he has developed for evaluating these programs. Much of his experience has been incorporated into the "Guidelines for NRC Postdoctoral Research Associateship Programs" which is included among the background papers sent you in advance of this conference.

Your consideration of our problems and your recommendations will be greatly appreciated.

DISCUSSION

Sunday evening, September 10, 1967

DR. MAGOUN: I gather all fellowships from U.S. agencies are limited to U.S. citizens. Dr. Curtis has pointed out 47% are non-U.S. citizens; however, money is given to universities and then funneled to postdoctorals.

DR. CURTIS: All fellowships from federal agencies are limited to U.S. citizens. 47% of the postdoctoral people are non-U.S. citizens. I will draw a further generalization. The large number of people supported by university money expended without reference are foreign postdoctorals. If this is true, it is one of the most important generalizations you would want to make. That is how foreign people get supported.

DR. DONSKER: However, Public Health Service fellowships are open to foreign nationals who have applied for permanent residence. This does not, of course, include individuals studying in the U.S. on a visiting or student visa.

DR. J.H.U. BROWN: Part of the reason why many postdoctorals are supported in the physical sciences is that the physical sciences are not able to secure the type of trainee support that is available in the biological sciences.

DR. MAURER: There is an imbalance in the distribution of postdoctorals -- men in high-energy and atomic/nuclear areas are supported because postdoctorals tend to accumulate where the Federal Government has placed funds. Then, too, large numbers of men are trained in these fields. There is a great deal of pressure for postdoctoral appointments among them.

DR. DONSKER: We had 210 applicants this year for postdoctoral training at Courant Institute. Predoctoral applications in mathematics are going up dramatically -- more so than in any other field. This is now reflected for the first time in the number of postdoctoral applicants. 3% of postdoctoral positions now are in mathematics. Within 5 years the picture will be significantly changed. The pressure is overwhelming. If you look at mathematics postdoctoral appointments, you will find that they are going up more than in any other field.

DR. KRAMER: With reference to Dr. Kelly's second problem in his talk -- one-year awards versus two-year awards -- we have been giving some thought at NSF to limiting tenures to 15 months.

DR. BORST: Are there any appointments in interdisciplinary fields? Is this a question that should be considered? Are there any interdisciplinary postdoctorals? What of the humanities and physical sciences?

DR. KELLY: These are sometimes difficult problems. In predoctoral programs we sometimes have separate subpanels. There is, for example, a subpanel in the field of computer science.

DR. BOYCE: You are dealing with new disciplines. Where would carbon-14 dating fall?

DR. KELLY: Probably in chemistry. Actually, it depends on the field of the Ph.D. of the person. If he is getting a Ph.D. in chemistry, his application would be given to the chemistry panel. If a Ph.D. in physics, it would go into physics.

DR. BORST: Quality in the postdoctoral research associateship programs has steadily increased. Generally speaking, competent people apply whom you would be happy to have in your laboratory.

DR. TRYTTEN: Some of the things we have talked about are being seriously affected by the draft. Graduate schools could face a severe situation next June. Postdoctoral education is an unknown quantity. We should present a better image of postdoctoral education so that its significance can be better known.

THE FUNDING OF POSTDOCTORAL FELLOWSHIPS AND ASSOCIATESHIPS IN RELATION TO NATIONAL MANPOWER REQUIREMENTS

Joseph S. Murtaugh

I am pleased to have this opportunity to participate in the discussion of the nature, dimensions, needs, and problems of postdoctoral education in universities. The task assigned to me has been to speak to the problem of the funding of postdoctoral fellowships and associateships in relation to national manpower requirements.

I am flattered by the assignment, but my remarks will indicate it was really flattery because I have no pat formula to offer. Rather than attempt to provide a magic equation to translate national manpower requirements into funding and into the specific numbers of postdoctorals required, I would like to attempt to give some sense of the dimensions of activity of the National Institutes of Health in this area, some of the purposes that we speak to and hope to achieve through the support of postdoctoral activities, some of the problems which this presents to us, and some of the general issues which, I think, confront us all with respect to postdoctorals. Incidentally, I will try to give some sense of the relationship of the numbers being supported here to national requirements in the best manner that I possibly can.

At the outset we are faced with the problem of definition. I think that was apparent last night in our preliminary discussions. Each of us has a different sense of what we are discussing. This class of academic society encompasses a wide variety of individuals, activities, and institutions receiving support through various devices from diverse sources. Thus, in this context, it is pretty difficult to obtain, to classify, and to analyze the data in respect to this universe. Dr. Brown last night stressed the hope that this discussion could concentrate on postdoctoral appointments made through the national programs of selection of fellows and through similar programs for the selection of associates. I find it difficult to limit the examination of postdoctoral activity relevant, for instance, to the objectives of NIH, even though I will be able to identify the extent of our activity in respect to the national Postdoctoral Fellowship Program of NIH.

At the outset, I would like to begin with the larger universities and move to the particular area of concern for this conference.

Dr. Curtis in directing the study has attempted to obtain a census of the entire postdoctoral population -- within the definition set forth for the study, of course. This census is without regard to the mechanism of support and would include both the postdoctorals supported through national selection programs as well as those appointed at institutional levels. The question of the size of this population is one that has been the subject of a number of discussions. Berelson, using the definition of postdoctorals as individuals on a university campus who are not regular faculty members and who are not degree candidates, estimated the postdoctoral population in 1960 at about 10,000 to 12,000 including approximately 1,800 to 2,100 postdoctoral fellows who were individually selected through national programs.

The data collected thus far in the current NRC study, as we have heard from Dr. Curtis, will probably include a total of some 12,000 questionnaires which have been returned, of which about 10,000 have been coded. It would appear this is somewhat more reflective of the universities than the population counted by Dr. Berelson.

Dr. Kelly and Dr. Curtis were kind enough to allow me access to some of the additional tabulations from the questionnaires. From this we are able to derive a summary of the number of postdoctoral appointees by supporting agencies (Table 1). The total number of questionnaires thus far coded at the time of this tabulation was 9,786. The proportion of the individuals being supported through Federal programs is roughly 62 percent. One of the problems here is the identification of the source of support by the individual responding. The Public Health Service has a number of programs, the majority being located in the National Institutes of Health. Including the other branches of the Public Health Service we find the total supported by PHS is about 38 percent. About 60 percent of the Federally supported postdoctoral fellows are supported by PHS.

This number of 3,673 being supported by the Public Health Service is one that I will pursue further later and attempt to reconcile with other data which Dr. Curtis mentioned last night. Our official report counted a larger number of appointees being supported through the programs of NIH than appeared in the NRC study.

Before going into that particular problem, let us look at another set of data from the coded questionnaires in the Study of Postdoctoral Education (Table 2), provided by Dr. Curtis and Dr. Kelly. This shows the number of postdoctoral appointees with a Ph.D. by the years elapsed since their doctoral degrees. I suspect these are some of the data that Dr. Curtis was getting at last night. We see that 77 percent of the individuals with Ph.D. degrees are involved in postdoctoral education within two years of receiving their doctorates. On the contrary, only 31 percent of M.D.'s are involved in postdoctoral education within two years and the modal group is in the three-to six-year period. As someone mentioned last night, this is attributable to the different education pattern of the M. D. which involves usually a year of internship and one to three years of residency training before the period of postdoctoral research or training for research.

Before going on to an examination of NIH, I'd like to take a moment to place the NIH activities in the context of the total NIH program (Table 3). This is an attempt to give us some sense of the proportion of NIH activity that is related to the support of training in contrast to the support and conduct of research. This is a long-term trend since 1950 and is what President Johnson described as the billion-dollar success story. The sharp decline that we see between '66 and '67 is not because he has changed his mind, but because we have not carried the analysis back through the previous years. The principal point here is that about 17 percent of the total NIH budget goes to the support of training through training grants and fellowship awards. Table 4 shows the training grants separate from fellowship awards.

Table 1

SOURCES OF SUPPORT FOR POST DOCTORAL FELLOWS

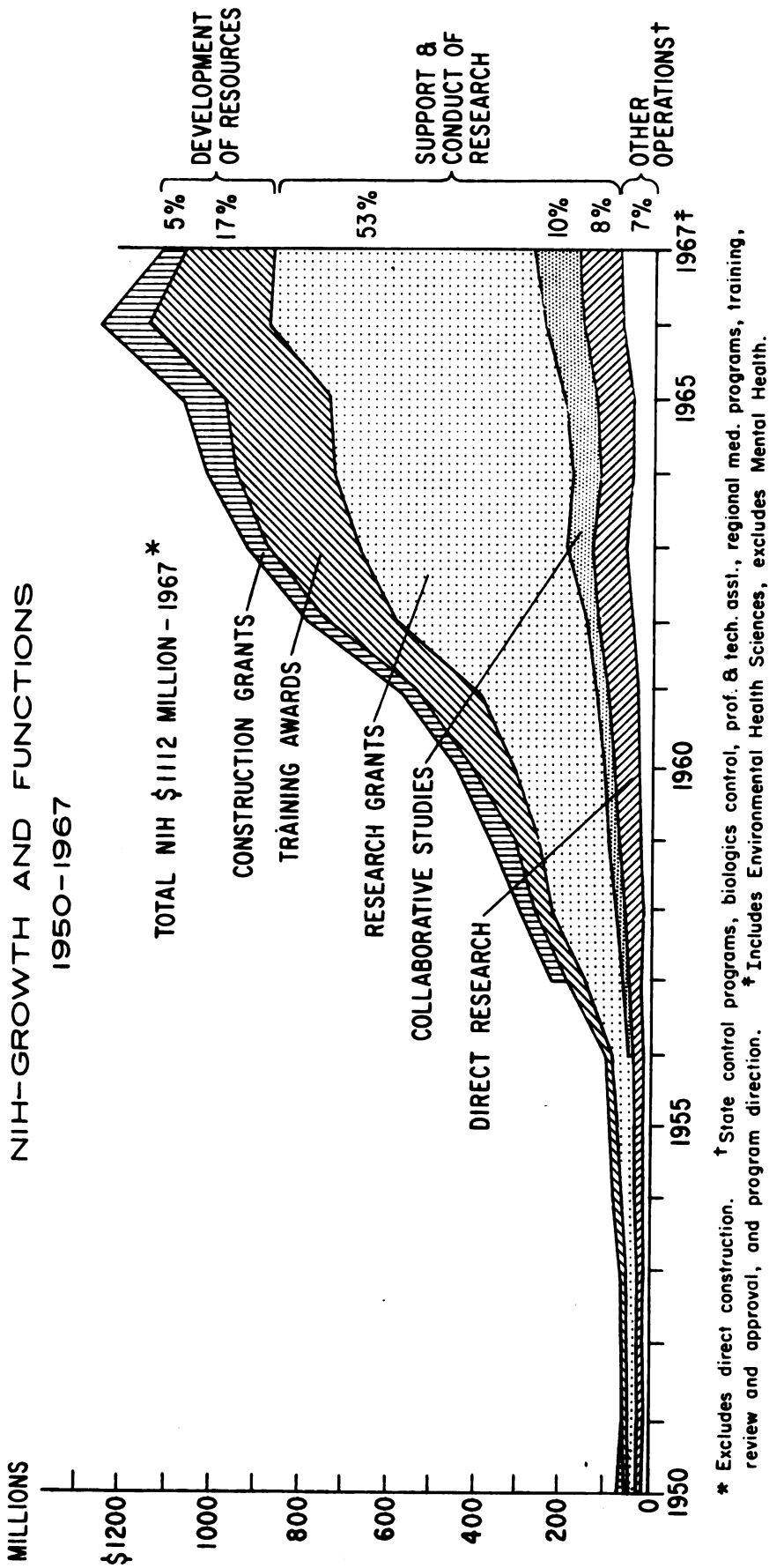
		NUMBER	PERCENTAGE
I. FEDERAL SUPPORT	– Total	6,039	61.9
PHS	– Total	3,673	37.6
NIH		2,590	26.6
NIMH		150	1.5
PHS (Unspecified)		933	9.5
NSF		880	9.0
AEC		725	7.4
Air Force		241	2.5
NASA		230	2.4
Navy		146	1.5
Army		144	1.5
II. NON-PROFIT ORGANIZATIONS	– Total	1,863	19.0
Funds from Home Country		199	2.0
Ford Foundation		111	1.1
Other Non-Profit		1,553	15.9
III. TRAINING INSTITUTION		808	8.3
IV. MULTIPLE SOURCES		697	7.1
V. UNKNOWN		379	3.9
	TOTAL	9,786	100.2

Table 2

DISTRIBUTION OF THE NUMBERS OF YEARS ELAPSING BETWEEN MOST RECENT M.D. OR Ph.D. DEGREE TO PRESENT POSTDOCTORAL APPOINTMENT

	Total	Ph.D. Only	M.D. Only	M.D. & Ph.D.
Total	9,582	6,449	2,843	290
	100.00	100.00	100.00	100.00
Under 2 Years	5,593	4,558	879	156
	58.37	77.11	30.95	62.16
3 – 6 Years	2,121	764	1,289	68
	22.14	12.92	45.37	27.09
7 – 9 Years	624	242	365	17
	6.51	4.10	12.85	6.77
Over	1,244	885	310	49
	12.98	5.87	10.84	3.99

Table 3



* Excludes direct construction. †State control programs, biologics control, prof. & tech. assl., regional med. programs, training, review and approval, and program direction. ‡Includes Environmental Health Sciences, excludes Mental Health.

Table 4

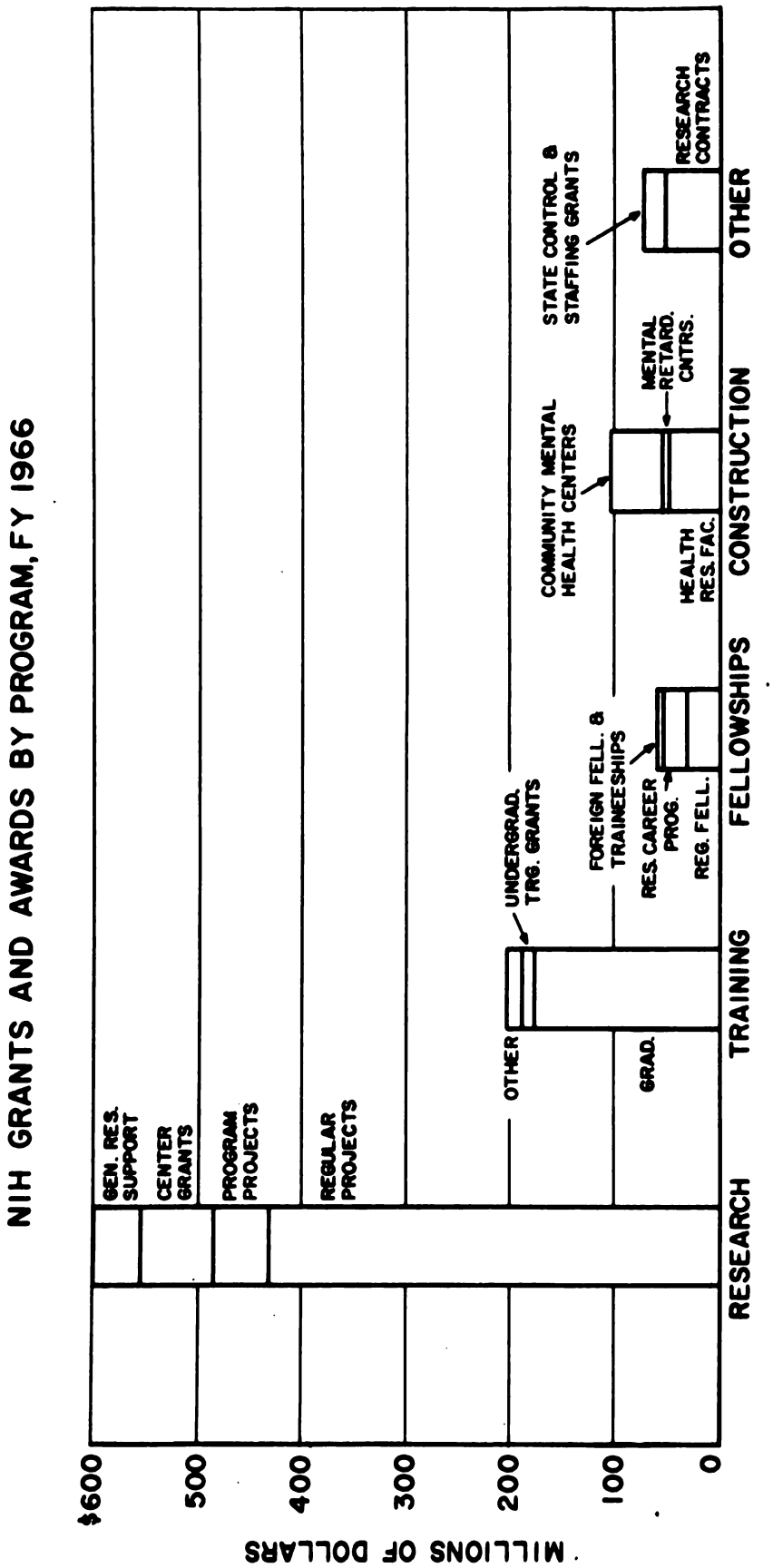


Table 5 takes that 17 percent item, which is represented as an expenditure of close to $261 million, and gives us a distribution of it by the form of support. In fiscal year 1966, the total expenditure was $261 million for training, of which the greater bulk went to grants to institutions for the support of the training activities in the relevant sciences. It is interesting to note at this point that only about 47 percent of that amount goes to provide stipends for trainees, and the remainder of this money, or some 53 percent, goes to support the structural processes. This has been a characteristic of the training grant. Substantial amounts of money have gone directly into a departmental structure through that mechanism.

The particular area of activity of concern here is the support of so-called full-time regular fellows. About $8,500,000 was expended to support approximately 1,238 fellows at that level.

Just briefly to discuss and give you a glimpse of some of the other activities, in addition to the training grants, there is fellowship support through national-competition programs. The individuals in these fields are selected nationally by national panels. In the full-time regular-fellowship category, the preponderance of the expenditure is for predoctoral fellowships. The "special" fellowships have a postdoctoral status, but are usually given to senior individuals on a sabbatical year who are doing some extraordinary kind of activity in relation to their field of interest.

In the foreign field, we are supporting some 150 foreign nationals in the United States, all at the postdoctoral level.

We have a major investment in what we call our Career Research Programs. The two elements are the Research Career Development Program and the Research Career Program. We have discontinued new appointments in the latter program for a variety of reasons, one of the principal reasons being that we found ourselves coming into direct employment relationship with individuals who occupied tenured positions on university faculties. We felt it was unwise for a Federal agency to be in that position. We had to discuss the questions of leave, promotions, and the conditions of employment as though the awardee were in Federal employment indeed. The individuals in this program who have been appointed are continuing to be supported; however, no new appointments are being made.

The Research Career Development Program is an important one involving the support of over a thousand individuals who are at least three years beyond their doctorate and who have had postdoctoral training. This is a means of enlarging the number of stable career positions available for medical research. This is a period of support that can go as long as eight years during the period when the awardee is becoming a part of the academic research team and before he faces the cold, hard life of the market place in seeking individual support either through academic advancement or independent research support.

I suspect in many cases that this Research Career Development Program is very comparable in its objectives to those initially sought. Dr. Kelly remarked last night that in the original National Research Fellowship Program, as constituted in the 1920's, one of the objectives was to enlarge the number of career opportunities for full-time research activities. This contrasts with the present postdoctoral fellowship role, which is providing in a sense additional training or additional educational experiences.

Table 5

THE NIH TRAINING PROGRAMS

Fiscal Year 1966

PROGRAM	DOLLARS (000's)	
Total*		261,407
Training Grants		205,733
Fellowships		53,627
Full-Time Regular Fellows	26,691	
Predoctoral		12,375
Postdoctoral		8,496
Special		5,820
Other	26,936	
Foreign		1,190
Research Career Development		20,355
Research Career		5,391
Traineeships		2,047

*Excludes Training Under General Research Support Grants

The existence of this number of different postdoctoral programs constitutes one of the problems we may wish to discuss further in this Conference.

Table 6 shows the trend from 1963 to 1966 in the number of people being supported.

First of all, traineeships per se -- not trainee appointments under training grants -- are a very small percentage of the total. They are aimed at providing advanced clinical training for clinical purposes in neurology and a few other fields. They support neurologists with certain activities in the field of cancer where specialized clinical capabilities are being sought. Whether they are appointed directly by the agency or not, there are also some who are appointed by out-of-training grants.

In contrast, individuals who are appointed from training grants to receive stipends are called trainees. Some of this terminology is a result of the kind of problems that we face with Congress, and the language calls for a certain kind of individual. Our statutory language calls them trainees, and other kinds of individuals are fellows. We preserve these distinctions, although they do not differ greatly by the nature of the work they are involved in. The traineeships are national appointments, and the so-called trainees are under the training-grants appointments.

Table 6 translates the 1966 dollar figure into actual numbers of persons in the NIH training programs. The total number of people being supported by the $261 million figure is 30,571 in 1966. This is the number of individuals who received stipends through NIH training programs in fiscal '66. You can see the distribution of the 10,186 postdoctorals, the number that was giving Dr. Curtis some concern last night. I will attempt a reconciliation of that later on.

The focus gets a little fuzzy here. The number of postdoctoral fellows is 2,078, which includes the 1,228 regular postdoctoral fellowships, the 481 special fellowships, 216 postdoctoral traineeships, and the 153 foreign fellowships to get up to the number which represents the nationally selected postdoctoral fellows. The regular postdoctoral fellowships program supported 1,228. The number being supported in Research Career and Research Career Development Programs is 1,247. Note that the numbers in Table 6 do not include individuals in postdoctoral status in intramural research programs of the National Institutes of Health, estimated to be roughly 345.

Table 7 gives the distribution by the programs of NIH and by form of support. You will note that the postdoctorals supported include those of the National Institute of Mental Health. Most of the NIMH support is for basic psychiatric residency people, who could be excluded from the count being made by Dr. Curtis. The principal institutes involved in postdoctoral support are the National Institute of General Medical Sciences, the Arthritis Institute, the Neurology Institute, and the Heart Institute. In programs of the latter three institutes the emphasis is heavily on the support of M.D.'s for research training in fields relevant to those categorical interests, and the great bulk of their support is for post-M.D. research training.

Table 6

NUMBER OF PERSONS IN NIH TRAINING PROGRAMS
FY 1963 – 1966

FY	No. of People Supported	TOTAL		INSTITUTIONAL SUPPORT		INDIVIDUAL SUPPORT		
				Training Grants & Gen. Res. Support		Fellowships & Traineeships		Research Career & Research Career Development Awards
		Post-doctoral	Pre-doctoral	Post-doctoral	Pre-doctoral	Post-doctoral	Pre-doctoral	Post-doctoral
1966	30,571	10,186	20,385	6,861	18,015	2,078	2,370	1,247
1965	28,918	9,687	19,132	6,534	17,124	2,010	2,008	1,143
1964	24,877	9,097	15,780	6,042	14,064	1,929	1,716	1,126
1963	19,137	8,238	10,899	5,366	9,275	2,005	1,624	867

Table 7

NUMBER OF INDIVIDUALS SUPPORTED
BY THE NIH TRAINING PROGRAMS

By Sponsoring Institute/Division
Fiscal Year 1966

Institute or Division	Total	Post-Doctoral	Pre-Doctoral
Total	30,571	10,186	20,385
Allergy	1,284	601	683
Arthritis	1,385	1,112	273
Cancer	983	634	349
Child Health	881	456	425
Dental	573	350	223
General Medical	10,313	1,894	8,419
Heart	1,820	1,214	606
Mental Health	9,341	2,365	6,976
Neurology	1,506	1,303	203
Research Facilities & Resources	2,332*	104*	2,228*
Office of International Research	153	153	--

*TRAINEES SUPPORTED UNDER GENERAL RESEARCH SUPPORT GRANTS

Table 8 narrows the focus to postdoctorals only and shows the postdoctorals distributed by forms of support -- those who are training under the training grants, those who are being supported under the national fellowships and training programs, and those receiving support through Research Career Programs grants. You will note the substantial support of trainees on the postdoctoral level with, as I mentioned, a large portion of it through the support of M.D.'s in the research training activities.

Table 9 is one that I would like to spend a little more time with in terms of this problem of reconciliation. Here is the distribution of those same sets of numbers of postdoctorals by discipline and with an attempt to correct for the full-time doctor. The count of some 10,186 is reduced to 8,625, which represents the full-time equivalent. I think I may attempt here to make a reconciliation between the numbers which Dr. Curtis has picked up in his study of individuals in postdoctoral status being supported through Public Health Service programs. If you will recall the figure was 3,673. If one subtracts from our total of 8,625 the 1,247 career-supported activities, the traineeships that I mentioned which were included in the number of fellowships, the 217 special fellows, and the 481 psychiatric residencies, and corrects for the difference between full time and part time, one reduces that figure of 8,625 to roughly 4,410, which is the figure comparable to the 3,673 of Dr. Curtis. This seems to be reasonable agreement, considering the problems of coverage.

Table 10 gives you the distribution of NIH-supported postdoctorals by degree and type of support. About 25 percent of our postdoctorals are Ph.D.'s receiving some additional research or training experience, and 75 percent are M.D.'s. The distribution is about half and half for the Ph.D.'s and M.D.'s holding fellowships and traineeships, but if corrected to represent only the regular postdoctoral fellowships, it shows that only about 40 percent of those are M.D.'s. You can see the preponderance of our efforts aimed at changing the physicians into scientists.

I would like now to come to the heart of the matter in a way that will provide some provocative matters for the course of the discussions. The objective of our training activities here is to increase the quantity and quality of research training, and thus the manpower available for medical research. The general function and role of postdoctoral support in the NIH programs has been first to provide research training to doctors in health projects, a major consideration in advancing medical research. Secondly, we want to provide advanced research training to Ph.D.'s in specialized fields where further academic work and experience is requisite to work on the frontier of scientific activity in fields relevant to health and medicine. We also want to expand the research dimensions of clinical areas that have not been or are not presently characterized by high-research activities, such as anesthesiology, ophthalmology, and others. You will note the tremendous interest for the establishment of a National Institute of Eye Research. This is basically reflective of the fact that there is very little eye-research activity related to the visual disorders. This derives from the fact that ophthalmology is a very lucrative profession, and there is very little entry of ophthalmologists into research activities. We are attempting to expand scientific effort in the field of visual disorders. We are also attempting to bring about some new horizons in the field of pharmacology and toxicology by training and also research activities in this respect.

Table 8

NUMBER OF POSTDOCTORAL INDIVIDUALS SUPPORTED
BY THE NIH TRAINING PROGRAMS

Type of Program by Sponsoring Institute/Division
Fiscal Year 1966

Institute or Division	Trainees Under Trng. Grants	Fellowships & Traineeships	Research Career & Research Career Development Awards
Total	6,861	2,078	1,247
Allergy	340	151	110
Arthritis	680	292	140
Cancer	376	174	84
Child Health	240	136	80
Dental	239	58	53
General Medical	1,136	425	333
Heart	777	253	184
Mental Health	2,095	127	143
Neurology	874	309	120
Research Facilities & Resources	104*	--	--
Office of International Research	--	153	--

*TRAINEES SUPPORTED UNDER GENERAL RESEARCH SUPPORT GRANTS

Table 9

NUMBER OF POSTDOCTORAL INDIVIDUALS SUPPORTED
BY THE NIH TRAINING PROGRAMS

By Discipline
Fiscal Year 1966

Discipline	Total		Trainees Under Training Grants*		Fellowships & Traineeships	Research Career & Research Career Development Awards
	Total	Full-Time	Total	Full-Time	Full-Time	Full-Time
Total	10,186	8,625	6,861	5,300	2,078	1,247
Biochemistry	748	643	257	152	311	180
Microbiology	539	464	233	158	187	119
Physiology	572	483	217	128	254	101
Genetics	259	203	125	69	84	50
Biology	55	44	33	22	16	6
Other Basic Sciences	1,631	1,274	1,013	656	360	258
Internal Medicine	1,564	1,332	1,122	890	213	229
Psychiatry	1,880	1,791	1,854	1,765	8	18
Other Clin. Medicine	1,808	1,479	1,455	1,126	239	114
Clinical Dentistry	203	144	153	94	35	15
Nursing	3	2	2	1	--	1
Social Work	3	3	1	1	2	--
Other Health-Rel. Prof's	337	226	223	112	90	24
Psychology	385	357	127	99	147	111
Social Sciences	58	53	24	19	18	16
Physical Sciences	127	119	15	7	109	3
Other	14	8	7	1	5	2

*TRAINEES SUPPORTED UNDER GENERAL RESEARCH SUPPORT GRANTS

Table 10

NUMBER OF POSTDOCTORAL INDIVIDUALS SUPPORTED
BY THE NIH FELLOWSHIP PROGRAMS

By Type Degree Held
Fiscal Year 1965

Type of Degree	Total	Trainees Under Training Grant*	Fellowships & Traineeships	Research Career & Research Career Development Awards
Total	10,085	6,861	2,025	1,199
Ph.D. or Equivalent	2,500	1,002	903	595
Md. or Equivalent	7,585**	5,859**	1,122**	604**

* INCLUDES TRAINEES SUPPORTED UNDER GENERAL RESEARCH SUPPORTED GRANTS

** INCLUDES TRAINEES THAT HOLD BOTH TYPES OF DEGREES

In addition, we have used the device of the Research Career and Research Development awards to increase the number of stable career opportunities for medical research by providing a very substantial period in which individuals at mid-career can work in the field in an academic setting prior to the time when they have to face the full rigors of the market place in terms of individual support through nationally competitive research programs or further advances in the academic scene. Finally, we want to provide advanced specialized clinical training in such fields as cancer, heart surgery, anesthesiology, neurology, and cerebro-vascular diseases.

The choice of mechanism here is a difficult one. We have not in the overall planning in NIH estimated the amount of money that we want to direct toward training activities. We have not been sophisticated enough to make these estimates in differential terms -- how much we are going to provide for training grants or how much we are going to provide for fellowships. In large part, I guess, we are attached to the pattern of the past which has heavily influenced us in terms of what we can expand on and what we cannot expand on in the future.

Our training grants are basically aimed at expanding the research-training capacity of the departments on the institutional scene. Support for the institutional processes as well as the stipends for trainees is included. Fellowships serve individuals by providing a choice of institutions and of the kind of postdoctoral experience the individual may be seeking. They also provide a standard of quality, a differential measure of institutional programs, and prestige for the awardees.

I pointed out earlier the tendency to expand the training grant as the mechanism of choice here. The number of postdoctoral fellowships has been held relatively constant over a considerable period of time, and, as a matter of fact, declined in 1966 or 1967. The administration of the national postdoctoral programs involves a fair amount of administrative effort. They involve the convening of panels of experts in various fields, something that burdens the individuals involved and also constitutes an administrative burden. Training grants are a somewhat more efficient mechanism for the support of training, but it also has a broader role.

As to funding requirements in this area, at the present in the N.I.H. we are attempting to make a projection of our manpower requirements for the next 20 years. We have, first of all, used the traditional pattern of projection based on the growth of the Gross National Product, taking that portion of the GNP that goes to medical resources and the total dollar expenditure per person supported, dividing the two, and getting a nice number representing the manpower required at any given level. This has been of some use.

The second device is one that appeals more to me -- a demographic method. One can examine the present flow patterns as people move from college into graduate schools and eventually into employment and try to project the number reaching the health-related fields. We are experimenting with that at the present time.

The third one is an attempt to make calculations of requirements of the consumers of trained people at an advanced level. The number of new medical

schools that we project for the future, the expansion of existing medical schools in terms of their faculty requirements and the necessary upgrading of the lower 40 percent of the medical schools of the country and the faculty requirements that national programs in the health fields will require provide a basis for projecting manpower requirements. In a field such as toxicology, we can make calculations based on what may be the consumer requirements and use this as base for determining our training activities. We are right in the middle of these projections at the present moment.

Dr. Rosenberg has turned out an enormous document reporting on efforts to bring these considerations down to meaningful, useful calculations. This is in the process of review. I might state that he projects a doubling of research manpower involved in medical research by 1975. We are trying to assess the validity of that projection and also its practicality in terms of the present budgetary circumstances. So, I have nothing concrete to offer concerning requirements, and I might say that other than the fact that we are into it up to our ears, it is a very difficult, complex problem.

I think that we must come to some conclusion concerning the academic function and role of the postdoctoral. Is this to be a further evolution of the scope of a university activity, that is, is the advance of scientific knowledge such that the attainment of the Ph.D. is not sufficient any more for competency in research? Is training beyond the Ph.D. a requisite for contemporary and future scientific activities? If that is the case, perhaps more formality should be brought to the recognizing of that additional period of training. Perhaps it would mean special boards and things of this nature so in a sense you would know that the level of achievement of an individual in this field is broadened. Perhaps this needs to be done in respect to the postdoctoral Ph.D. The relation of Federal programs to this is a critical one.

In a sense, the Federal program should not be the determinant of the character, role, and form of postdoctoral education in the university. I think it is up to the institutions to come to some agreement concerning the nature of this phenomenon to which Federal programs can relate. The article by Pitzer in Science not too long ago suggested some new approaches, which are quite intriguing in this respect. This, of course, involves evaluation of what is the consequence of postdoctoral activity. In the case of our own particular programs, some specific measures are sought in terms of numbers of these individuals who are engaged full time in academic and research activities in the fields relevant to health and medicine. This is the kind of venture that Jack Brown is concerned with in order to determine just what has resulted from the substantial expenditure on research programs.

FELLOWSHIPS AND RESEARCH GRANTS. WHAT IS THE PROPER ADMIXTURE OF THE TWO IN THE TOTAL NATIONAL PROGRAM?

Robert J. Maurer

I don't presume to answer this question. If I thought I could answer it, I wouldn't hesitate to be presumptuous. I am not quite sure but what it is one of those meaningless questions at the present time, which does not mean that you don't tackle it, but that you tackle it from the point of view of trying to decide what is the problem.

What I would like to do here, since time is short, is to focus upon two things. The first is the significant difference between the fellow and the research associate, with a little comment on why the difference exists. Secondly, in a problem of this type, I think it is always useful to look at limiting cases. By this means you can find out what your reaction is to these limiting cases and then proceed to situations that may be realistic or even appropriate.

First, about the research associate and the fellow. I think there are critical differences. I am looking at the problem from the point of view of the university, because that is where the research associate and the fellow work, and that is where they perform a useful function, if they do. I am not looking at it from the point of view of the Washington administration, or from the point of view of the fellow or research associate himself.

The research associate is ordinarily a member of the faculty, at most a junior member of the faculty. He is hired primarily for his competence in a given area with the thought that this competence will enhance both the research programs and the training of graduate students. The fellow, on the other hand, is a very different kind of beast. He is selected in a national competition, which has certain advantages and disadvantages over the research associate selection. He comes to the university as a kind of visiting guest in a relationship with obligations to it, and these may bulk very large in his mind. Furthermore, the fellow, like the research associate, consumes space and the time of the faculty, funds and equipment. His arrival on the campus in this role of consumer may not be tied in any way to the flow of funds or the availability of space to support him.

I would like also to comment on one other aspect of the relation of research associates to fellows. I really know the situation only as it exists in the physical sciences, and to a certain extent in engineering, but I would estimate that, according to my definition or description of fellows and research associates, in these fields there are at least ten times as many research associates as there are fellows. In many departments that I know the ratio is more nearly 20 or 30. All of these things are quite relevant to the problem of what is the proper mixture.

To come back to the status of the research associate, the research associate himself has become a fixture on the larger campuses because on our relatively affluent academic scene, the universities have taken on the support of research and graduate training as one of their primary functions. A large part of this function has been delegated to the younger faculty member -- the research associate. If you want to be a faculty member in a larger university, that is how you start. You don't start, probably, as an instructor of a generation or two ago. There has been a shift of emphasis of functions of

these young men. A generation ago the young man carried the teaching burden in the first few years of his academic life. Today, to a large extent, he is carrying the research burden. This is made possible by the flow of Federal funds into universities and by the adeptness with which the universities have made use of these funds to enhance their research capabilities.

This is not the whole story of the role of the research associate on the campus. He plays an exceedingly important role in the physical sciences and engineering in that the major universities are in direct competition with industry and government laboratories. It is very, very difficult for the Professor of Chemistry or the Professor of Civil Engineering or the Professor of Metallurgy to compete with organizations like Bell Laboratories or the Naval Research Laboratory in getting the research done. He has many chores, and they have grown with the years, not the least of them being Washington committees. The university professor uses research associates to establish his laboratory on a plane of quality that will lead to results which are worthy of being reported in the Physical Review or the Journal of the American Chemical Society, on a plane of quality equivalent to that at DuPont or Bell Laboratories.

To come to the limiting case, I'd like to consider two possible cases. One is that in which we eliminate the fellowship from the scene. There are no fellows. We have only the locally appointed research associate. The other case is that we abolish the research associateship, and we have only the fellow, as I have described him. The fellow is a man selected in a national competition with freedom to choose his own institution, and to me this is one of the critical aspects of a fellowship. Now, one would quickly come to the conclusion that a situation in which we would abolish the research associate and have only fellows would be intolerable. We would have first the problem of selection by a national competition. It is already a fairly burdensome thing to do this well. Some do select the fellows well. To do it for the total number of postdoctoral research associates that now exist would require a more automated method. Furthermore, we would again have the situation that those fellows who were selected would look to the prestige institutions. There would be a vast imbalance that could be avoided only by some form of limitation on their freedom of mobility. They would have to be limited to a geographical area or even to an institution. All we would have done is reinvent the research associate and have the management and determinations from Washington rather than locally. In view of the functions that a research associate performs on campus, that is not an appropriate way to do it. The research associate needs to be selected at least by the Department Chairman and preferably by the individual faculty member. Otherwise, he isn't going to be the right man for the job.

On the other hand, the other limiting case that I described -- where we would have only research associates and no fellows -- would be a completely realizable and livable proposition. There is nothing that I see in the academic scene that says one needs in any critical sense a fellow. The fellowship is in a sense a rewarding opportunity for the individual. The research associateship is an opportunity for the institution, although both may benefit. It is a starting point as I believe I have just described. I think we could get along without fellows. One comes to the conclusion that, aside from the mechanics of selection of fellows and the problems which are implied in it, the number of fellows should be small compared with the number of research associateships.

I would like to go a little bit further with this and explore what I hope aren't just personal prejudices concerning what a fellowship should be. I think a fellowship should give a very talented young man an opportunity which is distinctly greater than that of a merely competent Ph.D. The fellow should have the opportunity not merely to develop -- frankly, I think that a Ph.D. ought to be a competent researcher, taking appropriate recognition of his lack of experience -- but to do the work during his very energetic years. It should give him the opportunity to establish his independence as a scholar and to test what he can do so that the community will be able to look at him at the end of the year to say whether he really has the promise that we thought he had.

Therefore I would like to see the number of fellows small. They should be selected in a national competition of a very rigorous sort. I would like to see what they get in the form of fellowships be distinctly better than what a man gets if he is a research associate. I think there is a very unfortunate blurring of the line between research associates and the fellow. It is clear in our discussions that this blurring exists. The man himself doesn't know if he is a fellow or a research associate in some cases, although from the point of view of the university he may be quite a different character depending upon which status he holds.

I would like to see the fellow get a stipend that is distinctly superior to that of the research associate. In addition to this, he should have freedom of mobility. The fellowship should solve certain problems. It is my impression that of those men who enter the competition for fellowships, such as in the NSF postdoctoral fellowship programs, a large number do prefer to take a research-associate or industrial position, or even perhaps occasionally to go directly to a campus as an assistant professor. They apply for a fellowship because the fellowship is one of the few avenues which enable them to go abroad for a year or two. There is very little reason why a top-notch man should take a postdoctoral fellowship unless he wants to go abroad. If he is really a top-notch student, he will be recognized as such in the competition. There is no general problem in his going to a first-rate laboratory, possible even the faculty of his choice, but he looks for a fellowship because that way he can go to Oxford or to one of the European laboratories. I think that is a very important function that is worthy of fellowship support.

I think it is worthwhile to devote just a moment to this question of stipends. The research associate, by and large, is not well paid, and not well paid in the following terms. Typically, in the physical sciences and the more science-oriented engineering fields, the man of sufficient quality for a research associateship can go into industry where he will be given an opportunity to do relatively free research 100 percent of his time at salaries which may range in the order of $14,000 or $15,000 a year. Typically, he is paid nine or ten thousand dollars a year as a postdoctoral research associate. So, one of the problems that arises is that in certain fields the Ph.D. is not genuinely attracted to postdoctoral research associateships, and this problem is emphasized by the fact that in the more scientifically oriented programs the Ph.D. is not as strongly motivated towards an academic career as he is, say, in mathematics or physics. There are certain fields where academic employment still represents the best of all possible employments, but with the development of our present modern industry that has changed very much over what it was 20 or 30 years ago.

Now, these figures are calendar year figures. I know this varies from institution to institution, and it may also vary from one part of the country to another, but I don't think I am in the wrong ball park with them. I wish to emphasize that there is a very large differential, of the order of 30 to 50 percent, between the academic and industrial job. This looks awfully important to the young Ph.D. who is undoubtedly married. His wife thinks they better have some children soon, and she is tired of struggling through five years of graduate work.

I'd like to make one or two more comments. One concerns Dr. Kelly's comment yesterday of the high quality shown in the NSF postdoctoral fellowship programs. I think the statement can be made with complete truth, but, on the other hand, I think one can shift one's ground. I would like to do it and say that having shifted my ground I don't think that the quality is particularly good. It is not that the men who show up aren't really competent men -- perhaps 30 percent of them are really good -- but that the competition is not getting any more really first-class men. Distinguished men are choosing other avenues than fellowships, and the fellows are really second-rate by comparison with the men in first employment after receiving their Ph.D.

Now, on the other side, there are many problems associated with the research associate. There is a tendency to focus attention upon doing research with research associates and not with graduate students, and that is an abomination. I know men who have worked for five years with three research associates, and in that time have turned out, at the most, one Ph.D.

Those are problems, and everybody knows of them. I think that the distribution of research grants frequently puts into the hands of institutions and people funds which can't be used for graduate training and research. The funds are then used to hire postdoctoral men, and this is a bad use of money, particularly in view of the quality of institutions in many cases.

There is, perhaps, an excessive use of postdoctoral research-associate appointments to bring people from abroad. I have no quarrel against the first-class engineer from Italy or any other foreign country, but a great many postdoctoral appointments go to, say, Orientals. These men are frequently at about the level of a rather incompetent graduate student coming out of American institutions.

There are difficulties, but the research associateship meets a real need of the university today. That need is of such a nature that, just as the assistant professor or the professor, he should be locally selected and appointed. The fellowship can be, I think, exceedingly important in raising the standard and prestige associated with scientific research and in singling out for very special treatment the special young men. I am not convinced that it really does today.

DISTRIBUTION OF POSTDOCTORALS IN THE UNITED STATES

H. W. Magoun

The recent growth and current distribution of postdoctorals in the United States naturally holds a relationship to regional population density, displayed in Figure 1 and tabulated in Table 1, but can best be understood against the background of an increasingly large-scale Federal support of research and development in science and technology in this country over the two decades following World War II.

In fiscal 1965, for example, the growing annual Federal expenditure for R&D of all kinds reached $14.4 billion. The major share, about $9 billion, consisted of development funds which went largely to industrial organizations able to develop the products and services required by the nation for its various needs. Within the research component, $3 billion was expended in applied research undertaken principally in Federal laboratories and installations. A remaining $1.2 billion was allocated to academic institutions, both for their basic research which opens new fields for development, and for their graduate and postdoctoral education of the nation's specialist manpower in science and technology, who undergird the entire enterprise.

In their aggregate, such R&D activities have flourished most significantly in states along the Atlantic, Gulf, and Pacific coasts, as well as in the Midwest and, with lesser concentration, in other parts of the country. In fiscal 1965, for example, $4.6 billion or a third (32%) of the overall Federal R&D budget was expended in California; the next states being New York with $1.3 billion (9%), Maryland with $0.8 billion (6%), Massachusetts with $0.7 billion (5%), etc. The relative distribution of these 1965 funds to the top 25 states is depicted in Figure 2 and tabulated in Table 1.

Distribution of the Federal R&D component allocated to academic institutions for research and other educational activities has followed much the same pattern. In fiscal 1966, for example, when $2.1 billion of Federal funds were awarded to the country's top 100 universities and colleges, those in California received 12% of this total, those in New York 11%, those in Massachusetts 7%, etc. In addition to the awards along the Atlantic, Gulf and Pacific coasts, however, those to the Midwest were also of major dimensions. The distribution of 1966 Federal R&D funds for academic science to the top 25 universities in the country is presented in Figure 3 and Table 1.

The Director of the National Science Foundation, Dr. Leland J. Haworth, has been at pains to point out the close correspondence of levels of Federal support over the country (Figure 3) to those of population density (Figure 1) and degree awards (Figure 5), but admitted that there were significant exceptions to this generalization, particularly in California, New York, and Massachusetts, where the proportions of support were considerable higher than the percentages either of degrees awarded or of total population. "The principal reason for this he stated, "can be traced to the presence in these states of a number of large, very high-quality universities having faculties containing an unusual number of people of extraordinary research ability".

The identity of these high-quality universities is provided by institutional standings derived from the recent Cartter Report on Quality in Graduate Education (1964). The top 25 universities of the country, assessed by the quality of their graduate faculty, can be differentiated into upper, middle and lower clusters. The upper cluster includes Harvard, UC, Berkeley and, in more specialized fields, M.I.T. and Rockefeller University. The larger middle cluster, like the middle class of society, can be subdivided into an upper-middle: Yale, Princeton, Chicago, Stanford, Michigan, Wisconsin and Columbia, to which Cal Tech can be added; and a lower-middle group: UCLA, Johns Hopkins, Cornell, Illinois, Pennsylvania, Minnesota, Indiana, Northwestern, and the University of Washington, to which Purdue and Rice can be added. The lower cluster includes: Texas, North Carolina, Brown, New York University, Ohio State, Washington University (St. Louis) and Duke, to which Carnegie Tech, Brooklyn Polytech, Renssalaer and Case can be added. The geographic distribution of these highest-ranked universities in the Cartter Report is shown in Figure 4 and they are tabulated in Table 1. As seen in Table 1, twenty of these universities ranking in graduate education (Figure 4) are included in the 25 leading in Federal awards (Figure 3), but their relative order varies considerably. The five not included (Princeton, Northwestern, North Carolina, Brown and Duke) are supplanted by M.I.T., Penn State, Michigan State, Teachers College (Columbia), Iowa and Iowa State (Figure 5 and Table 1).

Against this background, the 25 universities with the highest enrollments of postdoctorals in 1966, shown in Figure 6 and tabulated in Table 1, are distributed, as might be expected, in much the same pattern, in Massachusetts, Connecticut, New York and Pennsylvania on the Atlantic coast; in Michigan, Wisconsin, and Illinois in the Midwest; in Texas on the Gulf coast; and in California and Washington on the Pacific. Twenty-one of the institutions leading in postdoctoral enrollment are included in the 25 leading in the quality of graduate faculties (Figure 4).

The commonality of geographic patterns illustrated in Figures 1-6 emphasizes the high degree to which the distribution of post-World War II Federal support, both of academic science and industrial R&D, corresponds to the loci of the country's universities which lead in the quality of their graduate faculty, in doctoral awards, and in postdoctoral enrollments. Across the country, four geographic regions can be identified, in each of which such Federal Agency awards both to universities and to industry have developed to peak proportions. Along the Atlantic coast, the eastern alps range from Massachusetts through Connecticut, New York, New Jersey and Pennsylvania to Maryland, with less prominent elevations as far south as Virginia and North Carolina. The midwestern alps include Michigan, Wisconsin and Illinois; Ohio, Minnesota and Missouri; and, less prominently, Indiana and Iowa. Along the Gulf coast, there is a major peak in Texas and a somewhat less prominent one in Florida. The Pacific alps include California and, less prominently, Washington. Additional elevations, usually created by special Federal activities, are present in Tennessee and Alabama in the southeast, and in Colorado, New Mexico and Arizona in the southwest. Whether actually flat or mountainous, the remaining intervening states, 25 in number or half the Union, are relatively lacking in such attractive economic and educational elevations. As might be expected, it is in these latter states and regions of the country that Congressional representatives are pressing for a more equitable geographic distribution of Federal awards while, in response, Federal Agencies are striving to develop in them additional new centers of academic excellence.

In this connection, a second group of 25 universities can be identified from the Cartter Report, whose standings are somewhat below those of the first group of 25 referred to above. Thirteen of the 25 in the second group are also located in the same states as the first group pointing again to the regional concentration of these leading institutions in the country. In the order of their ranking, these are: Michigan State, Rochester (N.Y.), Pittsburgh (Pa.), Rutgers (N.J.), Western Reserve (Ohio), Syracuse (N.Y.), UC, Davis (California), Pennsylvania State, Brandeis (Massachusetts), U. of Southern California, Maryland, Yeshiva (N.Y.), and Bryn Mawr (Pennsylvania). The remaining 12 of the second group of 25 universities are located in ten states not already represented above. In the order of their ranking, these 12 universities are: Iowa, Kansas, Oregon, Iowa State, Colorado, Tulane (Louisiana), Vanderbilt (Tennessee), Virginia, Utah, Emory (Georgia), Florida and Oregon State.

Against this background, the present distribution of postdoctorals in the United States is seen to form an important component of the recently developed pattern in which the research and related educational activities of a relatively small group of major universities are supported, in previously unheard of munificence, by a variety of Federal agencies. These advantaged universities are located in regions of high population density and, often, in or adjacent to major urban centers, where concentrations of Federal support to R&D industry also contribute significantly to the local economy. The rise and distribution of postdoctoral activities in this geographic and institutional pattern, over the past 20 years, constitutes one of the most striking developments in higher education of this country's recent history.

Moving now from the geographic and institutional distribution of postdoctorals over the country, consideration may next be directed to the intramural distribution of postdoctorals within the academic divisions of the individual university. Emphasis will be placed upon information available from the University of California, Los Angeles (UCLA), with the expectation that this is likely to provide a representative paradigm of many similar institutions.

A recent profile of the educational and research activities at UCLA, presented in Figure 7, shows the proportional representation in the divisions of the natural sciences, the social sciences, and the humanities and arts of: undergraduate enrollment, baccalaureate degree awards, graduate enrollment, master's degree awards, Ph.D. awards, postdoctoral enrollment, staff in the research appointment series, and extramural support for research and related educational activity. It is as apparent today as in 1963-64, when these data were compiled, that a remarkably good balance still exists in the lower educational stages of this spectrum, for each of the three academic divisions claims about a third (range 30-40%) of the total undergraduate and graduate enrollments, as well as of bachelor's and master's degree awards. Upon moving to more advanced, research-oriented education and to research activity itself, however, the profile of Ph.D. awards has already become significantly skewed in favor of the physical, life and health sciences; while profiles of postdoctoral enrollments, research appointments, and extramural awards for research and training, are so markedly distorted as to make these advantageous features almost exclusively prerogatives of the natural sciences and their professions. In these respects, the social sciences are rather markedly disadvantaged and the arts and humanities practically totally neglected.

In further elaboration, the growth of extramural support for research and related educational activities at UCLA since World War II, together with the proportional contributions of its various sources, is depicted in Figure 8. The profile of the first decade (1945-55) was a low plateau of between $4-$5 million per year, within which the decline of OSRD support at the end of the war was matched by funds from the Veterans Administration for returning GIs, by continuing awards from the Offices of Research of DOD, and by growing allocations from the newly-established Atomic Energy Commission and National Science Foundation, as well as from the expanding programs of the already existing National Institutes of Health.

In contrast, the profile of the second decade (1955-65) was marked by a precipitously upward trend, particularly following Sputnik in 1957, contributed to by other new or expanded Federal agencies (NASA, U.S. Office of Education, and the National Endowments for the Arts and Humanities), as well as by growing allocations from established agencies, chiefly the N.I.H. In just the last ten years, UCLA's annual extramural awards for research and training have risen from $5 million in 1956-57 to more than $50 million in 1966-67, an increase of the order of magnitude of 10.

The divisional distribution of these large sums within the university is shown in Figure 9. About 90% of the total was awarded to the fields of the natural sciences and their health, engineering and agricultural professions, in an approximate 60:30 ratio favoring the life sciences and its professions. Of the balance, 9% was awarded to the social sciences, while the arts and humanities received 1%. The proportional divisional representation of postdoctorals at UCLA was even more exageratedly in this pattern, as seen in Figure 10. In 1965-66, 97% of the postdoctorals were enrolled in the natural sciences, in a 67:30 ratio favoring the life sciences and health fields. The remaining 3% were in the social sciences, while the arts and humanities had none.

Just as the geographic distribution of postdoctorals was seen earlier to correspond closely to the regional and institutional distribution of Federal R&D awards over the country, so also the divisional representation of postdoctorals within the university corresponds closely to the predominant allocation of Federal awards for academic research and training to the natural sciences and their health and engineering professions. In the first instance, this imbalance has contributed to the distinction of advantaged and relatively disadvantaged regions and institutions over the county. In the second, even in the most affluent universities, the imbalance in Federal support of their academic divisions has contributed to the distinction of advantaged and relatively disadvantaged fields of learning.

Within the divisional representation of postdoctorals in the university, it is of interest to determine the extent to which they undertake their advanced study and research in departments or research units. Traditionally, the university's departmental programs in the classical disciplines have provided the focal emphasis not only of undergraduate and doctoral education, but of faculty involvement in project research as well. Along with the rise of postdoctoral study, extending the traditional pattern of graduate education beyond doctoral limits, the growth of Federal support since

World War II has led many universities to establish an increasing number of organized research units, in which the faculty from a variety of disciplines have extended their investigative activities beyond departmental limits, in collaborative interdisciplinary study of problems of great contemporary interest.

It is natural that these concurrent trends should have proven attractive to one another and, in 1966-67, 125 or more than half (57%) of 218 identified postdoctorals at UCLA pursued their advanced study and research in organized research units, rather than in departments. A subtotal of 114 postdoctorals were working in six research units in the natural sciences (98 in the life and health sciences, and 16 in the physical sciences and engineering), while 11 were working in five research units in the social sciences. In these settings, the 125 postdoctorals were associated with 708 graduate students and 386 faculty; as well as with a considerable number of additional investigators, holding the rank of assistant in the University's Research Appointment Series, many of whom could not easily be differentiated from postdoctorals.

A second instance of the significant role which organized research units have come to play in postdoctoral education is provided by data from the Brain Research Institute at UCLA over the period 1955-65. In this decade, 243 postdoctorals pursued advanced study and research in this interdisciplinary setting, usually for 1-2 years each. A subtotal of 27% of this group were doctoral graduates from 15 departments at UCLA; 36% came from 34 other institutions in the United States; while the remaining 47% were from abroad. Half (55%) of this latter group were from countries of the British Commonwealth and Europe; 34% were from Asia, with the largest proportion from Japan; while 11% were from Latin America. Without minimizing the importance of active departments, and over the past several years from 25-30% of all postdoctorals at UCLA have been in the Department of Chemistry (to which some refer as the "Institute of Chemistry"), these data point to the equivalent attractiveness of organized research units as settings for postdoctoral study in the contemporary university.

Turning finally from the several institutional aspects discussed above, a few distributional features of the postdoctoral's association with the university's faculty may be presented. Although much of the advanced study undertaken by postdoctorals may be pursued independently, most of their experience in research is gained under the supervision of or in direct collaboration with more mature and experienced investigators. By and larg this has been the prevailing practice for 210 identified postdoctorals associated with 108 faculty members at UCLA in 1967.

These postdoctorals were working with faculty in each of the four appointment series in the university as follows: 77% with faculty in the Academic Series, 20% with faculty in the Professor-in-Residence Series and 2% and 1% each with faculty in the Professional Research and the Clinical Appointment Series (Figure 11,A). Thus 97% of the postdoctorals were associated with faculty in the Academic or In-Residence Series, the latter being equated with the former in all respects except salary budget sources. Moreover, and in the same direction, with respect to faculty rank, 63% of the postdoctorals were associated with professors, 22% with associate professors, and 15% with assistant professors (Figure 11,B), indicating again the postdoctorals' predominant association with the more senior and experienced members of the faculty.

With respect to the number of postdoctorals per faculty member, in all categories, individual faculty were associated with between one and ten postdoctorals: 57% of the faculty were associated with one postdoctoral, 23% with two, 8% with three, 5% with four, 4% with five, and 1% each with six, eight, and ten postdoctorals (Figure 12). Thus, 88% of the faculty involved had from one to three postdoctorals working with them, 9% had four or five, and 3% had six, eight or ten postdoctorals. As might be expected, the latter 12% of faculty were among the most distinguished of the university's investigators and each was involved in a large-scale and exceedingly productive research program.

Some of the more important features of the information presented above may now be elaborated and general conclusions drawn. First of all, the geographic and institutional aspects of the recent rise and current distribution of postdoctorals in this country seem accountable in terms of the concentrations of outstanding faculty and programs of research and advanced education that have developed in a group of leading universities in four areas of the U.S., in the Northeast, Midwest, Pacific and Gulf regions.

The rise of this group of leading universities goes back to the founding of Harvard College in 1636, and they consisted initially of institutions established by private enterprise or individual philanthropy, first along the Atlantic coast and later across the country, in the Midwest and the Pacific. The Morrill Act of 1862 provided Federal aid for the establishment throughout the country of additional, publicly-supported Land Grant Colleges and State universities, a number of which have since gained positions among the leading institutions, particularly in the Midwest and on the Pacific and Gulf coasts.

The development of large-scale Federal support of university research and related educational activities in this country also had precedents in the 19th century, particularly in the field of agriculture, but its present scope has evolved chiefly over the two decades following World War II. Until quite recently, it was the policy of these Federal programs to make awards only or chiefly to institutions where outstanding investigators and opportunities for research already existed; hence the leading universities naturally tended to receive the predominant share of these awards. Today, these programs have achieved their objectives with such success that the cumulative availability of facilities, faculty and Federally-supported research in the leading universities make them jajor attractions, drawing graduate students and postdoctorals from less-advantaged institutions and regions of this country, as well as from many countries abroad, where such resources are also less well-developed. In this respect, concern over the brain drain now seems as relevant to the drain from less-advantaged to more-advantaged regions of the United States, as to the drain from foreign countries to our own.

A first major problem area in postdoctoral education in the United States is concerned, therefore, with the limited regional and institutional distribution of leading settings for research and related higher educational activities. Our country is exceedingly fortunate in having developed a group of highly-advantaged universities in four of its geographic regions but, without policy or provision for their multiplication and dispersion, these seem presently to be drawing away investigators, postdoctorals, graduate students and funds from other less-advantaged regions and institutions, both in the

rest of this country and abroad, thereby increasing the latter's relative disadvantage and introducing what Merton has called "the Matthew effect" in science. As will be remembered, the Gospel according to St. Matthew points out, "For unto everyone that hath shall be given, and he shall have abundance: But from him that has not, shall be taken away even that which he hath."

Growing concern over this national imbalance, to which Federal R&D programs appeared to be contributing, led President Johnson in 1965 to make the following statement on "Strengthening Academic Capability for Science to his Cabinet":

> "The purpose of the new policy I am issuing today is to insure that our programs for Federal support of research in colleges and universities contribute more to the long-run strengthening of the universities and colleges so that these institutions can best serve the nation in the years ahead.
>
> "At present one-half of the Federal expenditures for research go to twenty major institutions, most of which were strong before the advent of Federal research funds. During the period of increasing Federal support since World War II, the number of institutions carrying out research and providing advanced education has grown impressively. Strong centers have developed in areas which were previously not well served. It is the particular purpose of this policy to accelerate this beneficial trend since the funds are still concentrated in too few institutions in too few areas of the country. We want to find excellence and build it up wherever it is found so that creative centers of excellence may grow in every part of the nation...
>
> "I am asking each Agency and Department with major research responsibilities to re-examine its practices in the financing of research. I want to be sure that, consistent with Agency missions and objectives, all practical measures have been taken to strengthen the institutions where research now goes on, and to help additional institutions to become more effective centers for teaching and research."

Since that time, the Hearings on Equitable Distribution of R&D Funds by Government Agencies, before the Senate Subcommittee on Government Research, of which Senator Fred R. Harris of Oklahoma is Chairman, have grown to 762 printed pages of fascinating reading. In fiscal 1967, it may be noted, almost $200 million of Federal agency-support had been allocated to the development of additional centers of excellence in this country, through programs of NSF, OE, PHS, NIH and DOD.

A second major problem area in postdoctoral education in the U.S. is concerned with the concurrently imbalanced distribution of postdoctorals within the academic divisions of the individual university. Most of them are in the fields of the natural sciences and their health and engineering professions where the opportunities for support are abundant. Their number in the social sciences, arts and humanities is relatively small, as are the opportunities for research support. This situation contributes to the development of advantaged and of relatively disadvantaged areas of intellectual activity within the university.

The major Federal programs supporting postdoctoral study and research in their present distribution grew quite directly out of the programs of the World War II Office of Scientific Research and Development. As the war drew to an end, in 1944, shortly before his death, President Roosevelt wrote to Dr. Vannevar Bush, then President of the Carnegie Institution of Washington, as follows:

> "The Office of Scientific Research and Development of which you are the Director, represents a unique experiment of teamwork and cooperation in coordinating scientific research, and applying existing scientific knowledge to the solution of technical problems paramount in war...
>
> "There is, however, no reason why the lessons to be found in this experiment cannot be profitably employed in times of peace. The information, the techniques, and the research experience developed by the Office of Scientific Research and Development, and by the thousands of scientists in the universities and in private industry, should be used in the days of peace ahead for the improvement of the national health, the creation of new enterprises bringing new jobs, and the betterment of the national standard of living.
>
> "New frontiers of the mind are before us and, if they are pioneered with the same vision, boldness, and drive with which we have waged this war, we can create a fuller and more fruitful employment and a fuller and more fruitful life..."

Bush's reply, a report entitled Science: The Endless Frontier, actually blueprinted most of the developments that have since come to pass. With all factors working for them, it was natural that these developments should have emphasized so predominantly the Federal support of the natural sciences and their health and engineering professions. Within the universities, however, increasing concern has developed over the imbalance of support to the several areas of learning, for a reasonably balanced research effort in a university requires comparable activity in the social sciences and the arts and humanities as well.

An almost unbelievable improvement has recently been initiated, however, in the fields of the arts and humanities. In 1963, the American Council of Learned Societies, the Council of Graduate Schools and the United Chapters of Phi Beta Kappa co-sponsored a National Commission on the Humanities, to consider the state of these fields and report its findings and recommendations. The report of the Commission is itself a document of great literary merit. It begins:

> "The humanities are the study of that which is most human. Throughout man's conscious past they have played an essential role in forming, preserving and transforming the social, moral and aesthetic values of every man in every age. One cannot speak of history or culture apart from the humanities. They not only record our lives; our lives are the very substance they are made of. Their subject is everyman. We propose, therefore, a program for all our people, a program to meet the need no less serious than that for national defense.

> We speak in truth for what is being defended -- our beliefs, our ideals, our highest achievements... The challenge is no less critical and direct than the one we have already met with our strong advocacy of healthy and generously supported science. It must be met in turn with equal vision and resolve...
>
> "Traditionally our government has entered areas where there were overt difficulties or where an opportunity had been opened for exceptional achievement. The humanities fit both categories, for the potential achievements are enormous while the troubles stemming from inadequate support are comparably great. The problems are of nationwide scope and interest. Upon the humanities depend the national ethic and morality, the national aesthetic and beauty or lack of it, the national use of our environment and of our material accomplishments -- each of these areas directly affects each of us as individuals. On our knowledge of men, their past and their present, depends our ability to make judgments -- not least those involving our control of nature, of ourselves, and of our destiny. Is it not in the national interest that these judgments be strong and good?
>
> "The stakes are so high and the issues of such magnitude that the humanities must have substantial help, both from the Federal Government and from other sources. It is for these reasons that the Commission recommends the establishment by the President and the Congress of the United States of a National Humanities Foundation to parallel the National Science Foundation, which is so successfully carrying out the public responsibilities entrusted to it."

In 1965, President Lyndon B. Johnson signed into law Congressional Legislation establishing a National Foundation for the Arts and Humanities. Speaking to more than 300 writers, actors, scholars, educators, painters, directors and producers surrounding him in the White House Rose Garden, the President said:

> "In the long history of man, countless empires and nations have come and gone. Those which created no lasting works of art are reduced today to short footnotes in history's catalog... It is in our works of art that we reveal to ourselves, and to others, the inner vision which guides us as a nation.
>
> "We in America have not always been kind to the artists and the scholars who are the creators and the keepers of our vision...Somehow the scientists always seem to get to the penthouse, while the arts and humanities get the basement."

It is of interest to note that in the first year of its budgeted operation, the infant Foundation for the Arts and Humanities established a national program of postdoctoral fellowships in the areas of its responsibilities.

Support for research and advanced educational activities in the social sciences has also increased significantly in recent years, but through a variety of relatively limited awards, many from agencies whose primary

missions lay in other fields. Under its mandate for "other sciences," the National Science Foundation has continued to increase its research allocations and will, this year, initiate a traineeship program in the social sciences. The National Institute of Mental Health, now a Bureau, has long provided significant support for a number of areas of the behavioral and social sciences, as have also the National Institute of General Medical Sciences and that of Child Health and Human Development. The greatly expanded programs of the U.S. Office of Education, the Welfare Division of HEW, and several additional bureaus and departments involved in programs of "The Great Society" have provided further support.

Climaxing these activities, in 1966, a bill was introduced in Congress "to establish a National Foundation for the Social Sciences as an independent agency of the government for the purpose of promoting research and scholarship in the social sciences." Hearings on it before the Subcommittee on Government Research, of which Senator Fred R. Harris, Oklahoma, is Chairman, have now grown to 809 printed pages. Testimony has ranged from enthusiasm for an independent agency, to provide visibility and focal concern for support of the social sciences at the Federal level, to advocacy of growth of support for these fields by the existing National Science Foundation and a number of other established agencies, thereby avoiding the delay of getting a new agency into operation, providing for multiple agency sources of support, and promoting the closer association of the social sciences with other fields. One of the more striking suggestions in this latter direction, made to the Subcommittee by Professor A. Wildavsky, Chairman of the Department of Political Science, U.C., Berkeley, pointed out:

> "You really have two alternatives: Either to go with a separate organization, or to really give a big push to something in the National Science Foundation. An important question is how to interest the NSF in this, beyond the strategic point of heading off a separate organization. So I think one point would be to ask the NSF to come in with a new program itself, along the following lines: (1) a change in its name (to National Physical and Social Science Foundation); (2) a social scientist at its head; (3) a commitment to seek increased funds along the lines that this committee in social sciences are interested in; and (4) hiring of social scientists in various divisions."

Senator Harris forwarded this proposal to Dr. Haworth, Director of the National Science Foundation, requesting his reaction. Beyond pointing out that the NSF had already appointed a number of social scientists to its staff, Director Haworth's reply might be described as noncommittal in its support. It may be mentioned in this connection, however, that the American Association for the Advancement of Science has this year, for the first time, elected a social scientist, Dean Don K. Price, of the Joh Fitzgerald Kennedy School of Government at Harvard, as its President.

Finally, then, to sum up the entire matter very briefly:

(1) Both the geographic distribution of postdoctorals in regions and institutions over the country, and their distribution in fields of intellectual activity within the universities, are presently imbalanced.

(2) Postdoctorals are currently concentrated in a relatively small number of advantaged regions and institutions in the country and, within

universities, are primarily represented in the fields of the natural sciences and their health and engineering professions.

(3) Steps are presently being taken to broaden both the geographic and institutional range of postdoctorals' distribution and to provide increased opportunities for their study and research in the social sciences and the arts and humanities.

(4) These steps are needed and efforts already underway in this direction should receive all possible support.

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Table 1

DISTRIBUTION OF FEDERAL R&D FUNDS, TOP-RANKING UNIVERSITIES, DOCTORAL AWARDS, AND POSTDOCTORAL ENROLLMENTS IN THE UNITED STATES

Fig. 1 25 Most Populous States, 1966 Population	Million	Fig. 2 Fed. R&D Oblig. Top 25 States, 1965 ($14.3 billion)	%	Fig. 3 Fed. Support for Academic Science Top 25 Univ., 1966 ($2.1 billion)	%	Fig. 4 Cartter Report Ranking, Top 25 Universities,* 1964	Fig. 5 Doctorates Granted Top 25 Universities, 1960-66	No.	Fig. 6 Estimated Number of Postdoctorals Top 25 Universities, 1967	No.
1. Calif.	18.9	Calif.	31.72	U. of Mich.	2.20	Harvard	UC, Berkeley	3228	Harvard	760
2. N.Y.	18.3	N.Y.	8.98	M.I.T.	2.10	UC, Berkeley	U. of Illinois	3224	Yale	405
3. Penn.	12.0	Md.	6.11	Standord	2.01	Yale	U. Of Wisconsin	3143	U. of Wisconsin	355
4. Texas	11.0	Mass.	5.11	Columbia	2.00	Princeton	Harvard	3057	M.I.T.	350
5. Ill.	11.0	Texas	5.09	U. of Ill.	1.94	U. of Chicago	Columbia	3698	UC (Berkeley)	350
6. Ohio	10.0	Penn.	3.68	Harvard	1.79	Standord	U. of Mich.	2551	Stanford	320
7. Mich.	8.0	Florida	3.20	UCLA	1.70	Michigan	N.Y.U.	2331	Johns Hopkins	320
8. N.J.	7.0	N. Mexico	2.96	UC(Berkeley)	1.67	Wisconsin	Ohio State	2213	U. of Illinois	295
9. Florida	6.0	N.J.	2.86	U. Chicago	1.50	Columbia	Minnesota	2129	U. of Chicago	290
10. Mass.	5.0	Ohio	2.64	Ohio State	1.29	UCLA	Standord	2009	U. of Minnesota	290
11. N.C.	5.0	La.	2.63	Penn.	1.29	Johns Hopkins	Indiana	1987	Cornell	260
12. Ind.	5.0	Wash.DC	2.61	Wisconsin	1.28	Cornell	Purdue	1979	U. of Penn.	255
13. Mo.	5.0	Ala.	2.58	Texas	1.27	Illinois	M.I.T.	1911	U. of Texas	245
14. Va.	5.0	Va.	1.98	N.Y.U.	1.25	Penn.	Cornell	1833	UCLA	245
15. Ga.	4.0	Mo.	1.61	Penn. State	1.25	Minnesota	Mich. State	1833	Cal. Tech.	225
16. Wisc.	4.0	Wash.	1.49	Minnesota	1.19	Indiana	U. of Chicago	1816	Duke	220
17. Tenn.	4.0	Colo.	1.48	U. of Wash.	1.18	Northwestern	Yale	1772	U. of Wash.	195
18. Md.	4.0	Tenn.	1.42	Cornell	1.17	U. of Wash.	UCLA	1658	Columbia	185
19. La.	4.0	Ill.	1.34	Johns Hopkins	1.06	Texas	Texas	1552	Case	185
20. Minn.	4.0	Conn.	1.29	Yale	.99	N. Carolina	Penn.	1375	U. of N. Carolina	165
21. Ala.	4.0	Mich.	1.08	Wash. U.	.90	Brown	Penn. State	1373	U. of Michigan	165
22. Ky.	3.0		1.08	Missouri	.88	N.Y.U.	Iowa	1346	Northwestern	155
23. Wash.	3.0	Wisc.	.88	Indiana	.87	Ohio State	TC, Columbia	1294	Princeton	150
24. Conn.	3.0	Minn.	.74	Purdue	.87	Wash. U.	Northwestern	1278	Ohio State	140
25. Iowa	3.0	Ariz.	.53	Florida	.84	Duke	Iowa State	1240	Pittsburgh	135

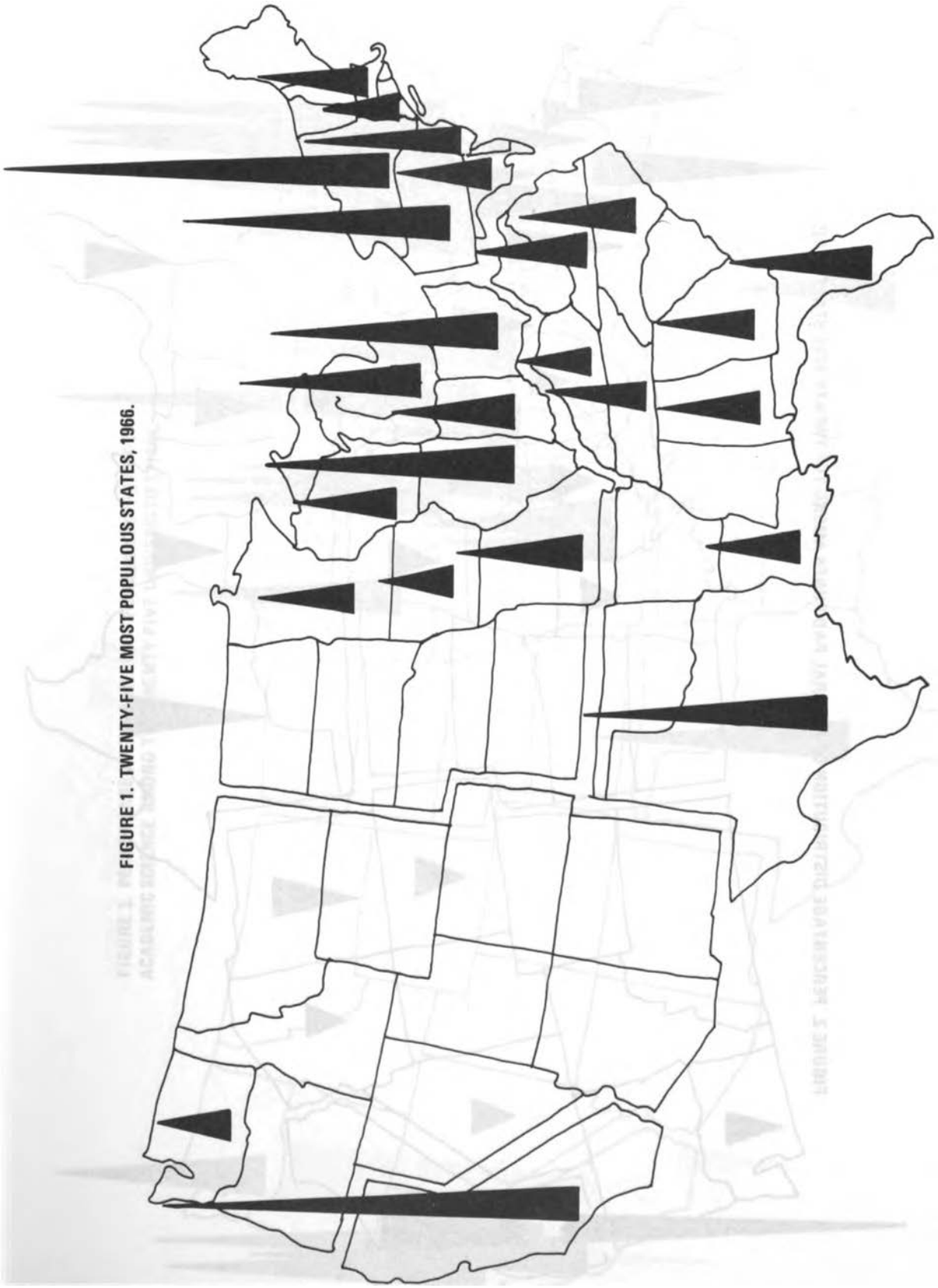


FIGURE 1. TWENTY-FIVE MOST POPULOUS STATES, 1966.

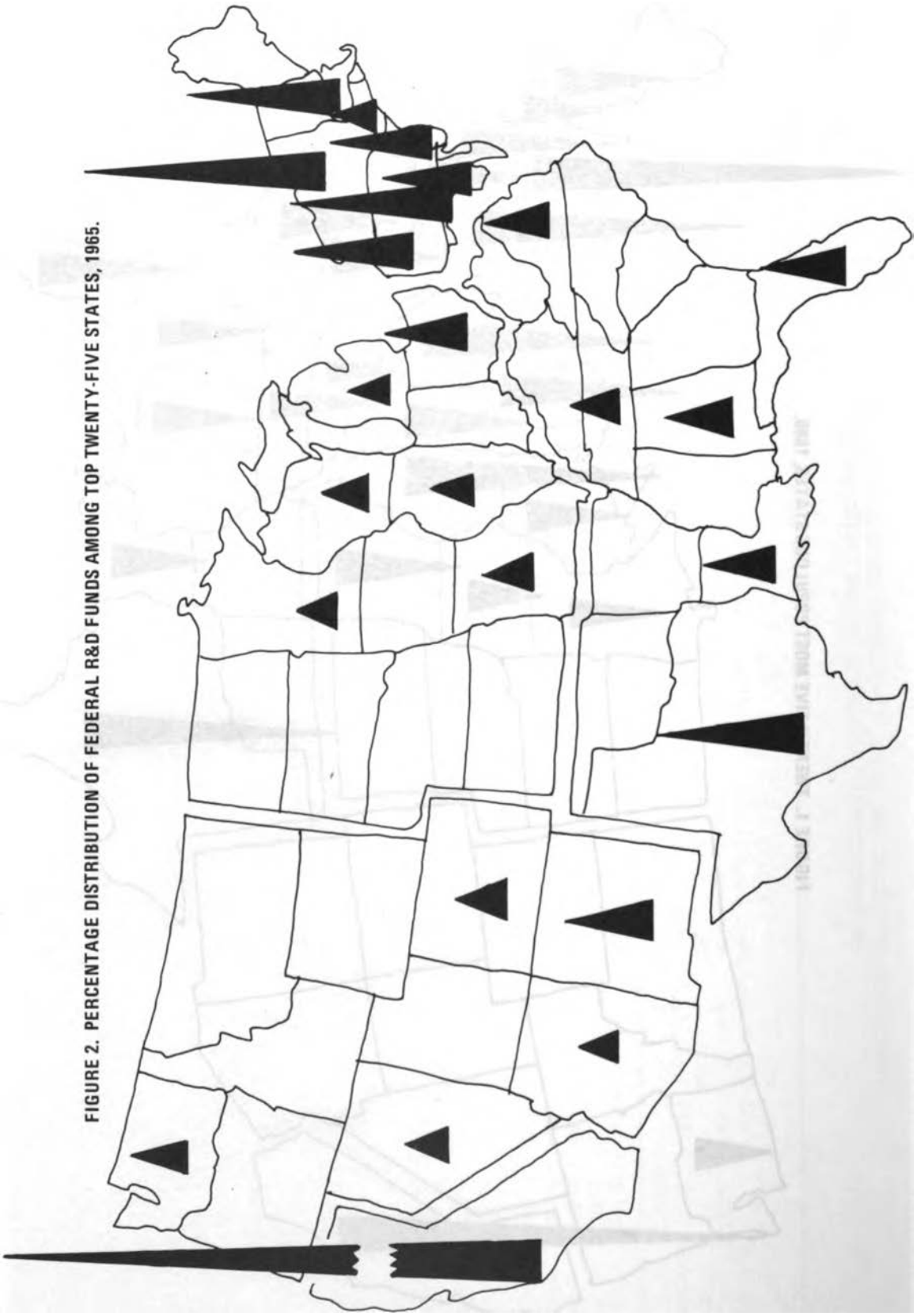


FIGURE 2. PERCENTAGE DISTRIBUTION OF FEDERAL R&D FUNDS AMONG TOP TWENTY-FIVE STATES, 1965.

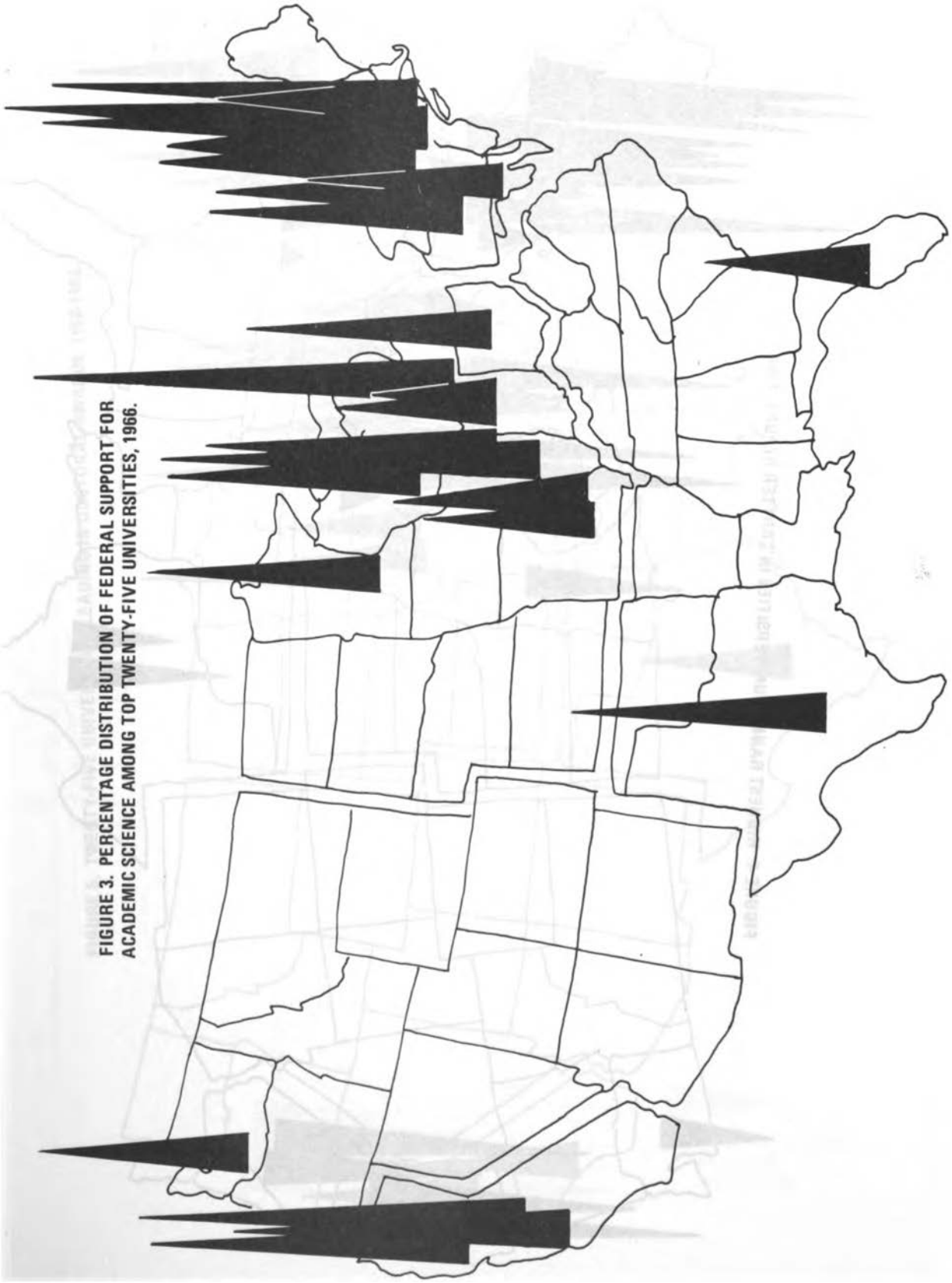


FIGURE 3. PERCENTAGE DISTRIBUTION OF FEDERAL SUPPORT FOR ACADEMIC SCIENCE AMONG TOP TWENTY-FIVE UNIVERSITIES, 1966.

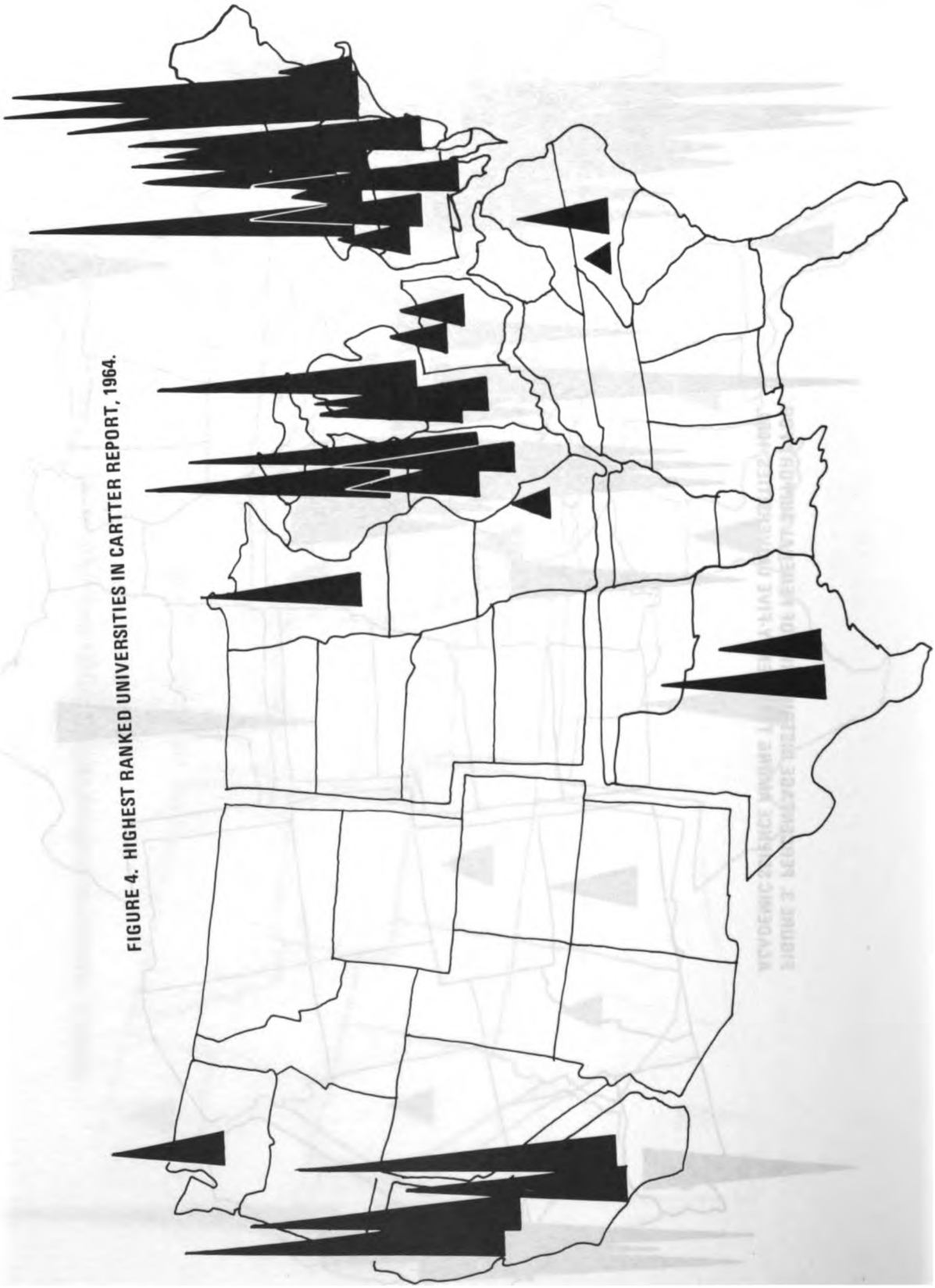


FIGURE 4. HIGHEST RANKED UNIVERSITIES IN CARTTER REPORT, 1964.

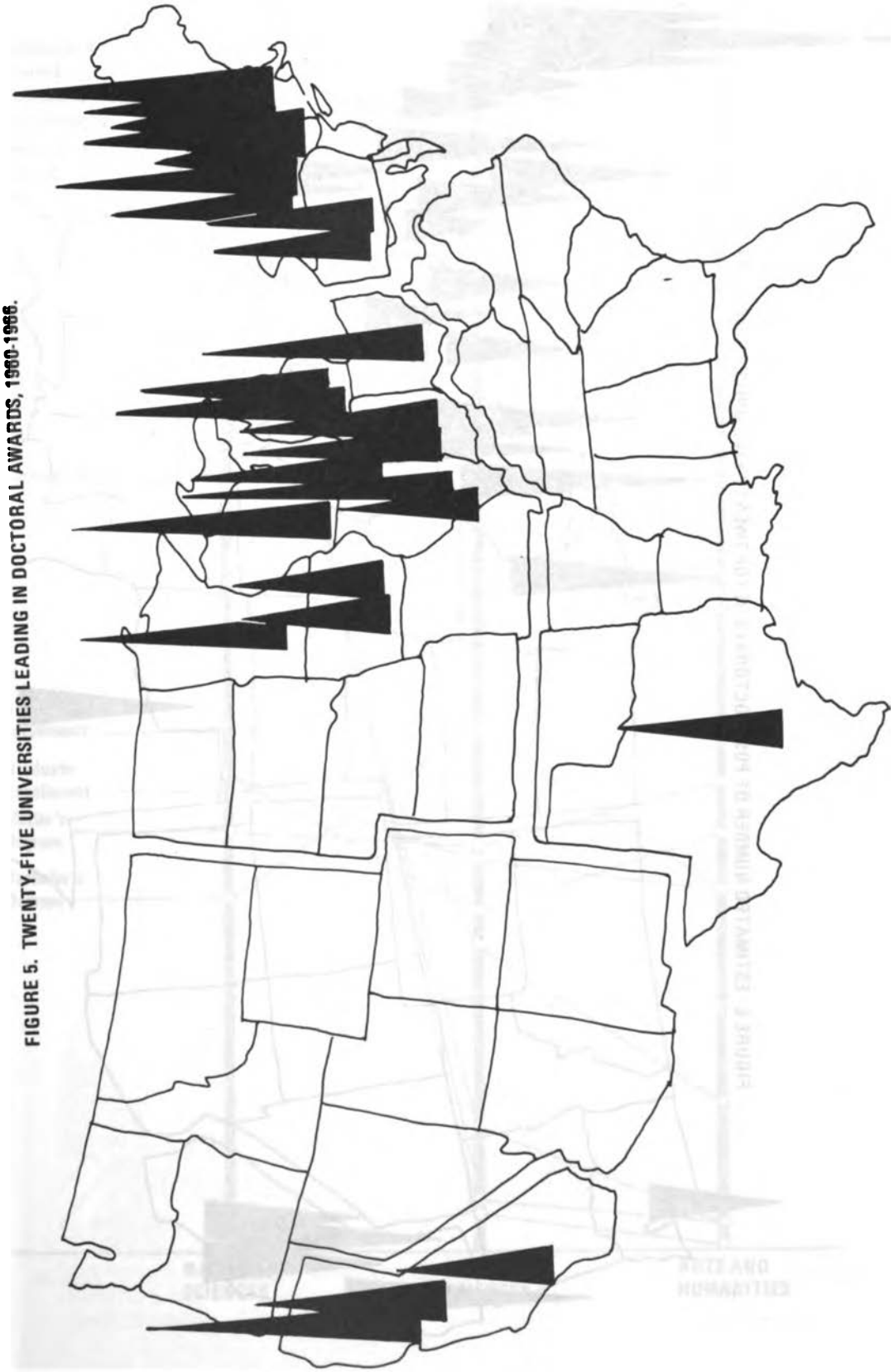


FIGURE 5. TWENTY-FIVE UNIVERSITIES LEADING IN DOCTORAL AWARDS, 1960-1966.

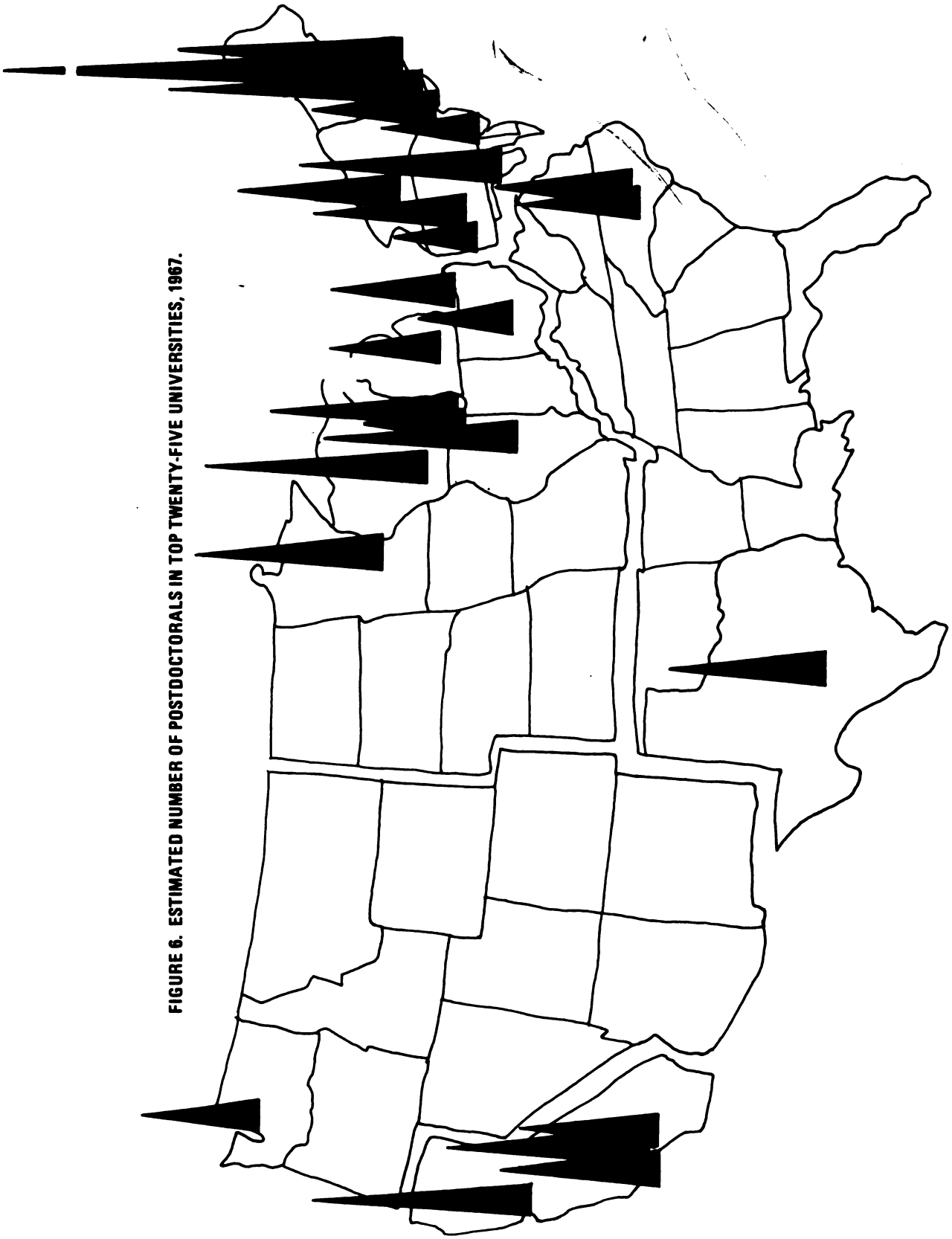


FIGURE 6. ESTIMATED NUMBER OF POSTDOCTORALS IN TOP TWENTY-FIVE UNIVERSITIES, 1967.

FIGURE 7. PROFILE OF EDUCATION AND RESEARCH ACTIVITIES IN ACADEMIC FIELDS: UCLA, 1963-1964

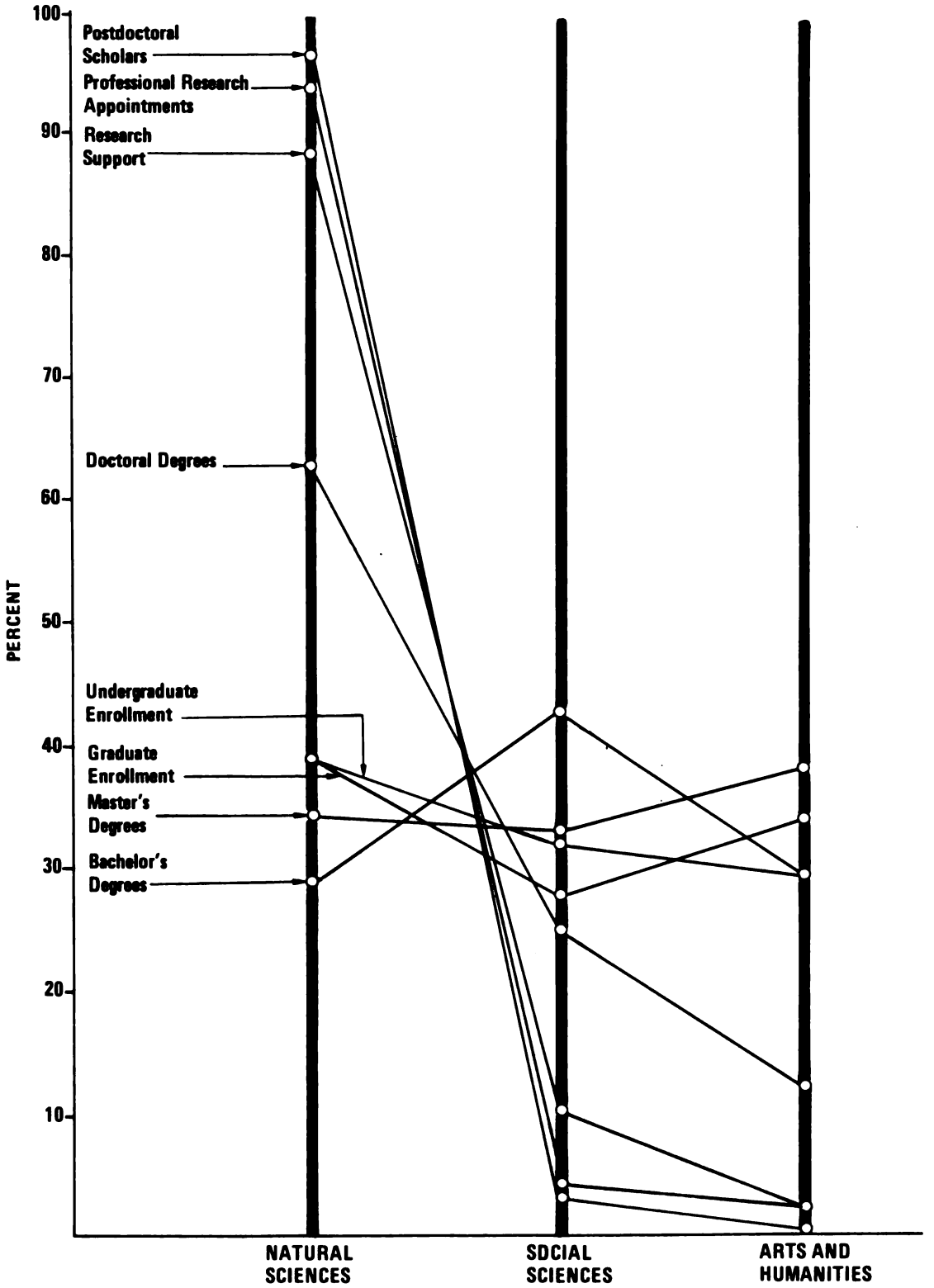


FIGURE 8. EXTRAMURAL SUPPORT FOR RESEARCH & TRAINING: UCLA, 1945-1966.

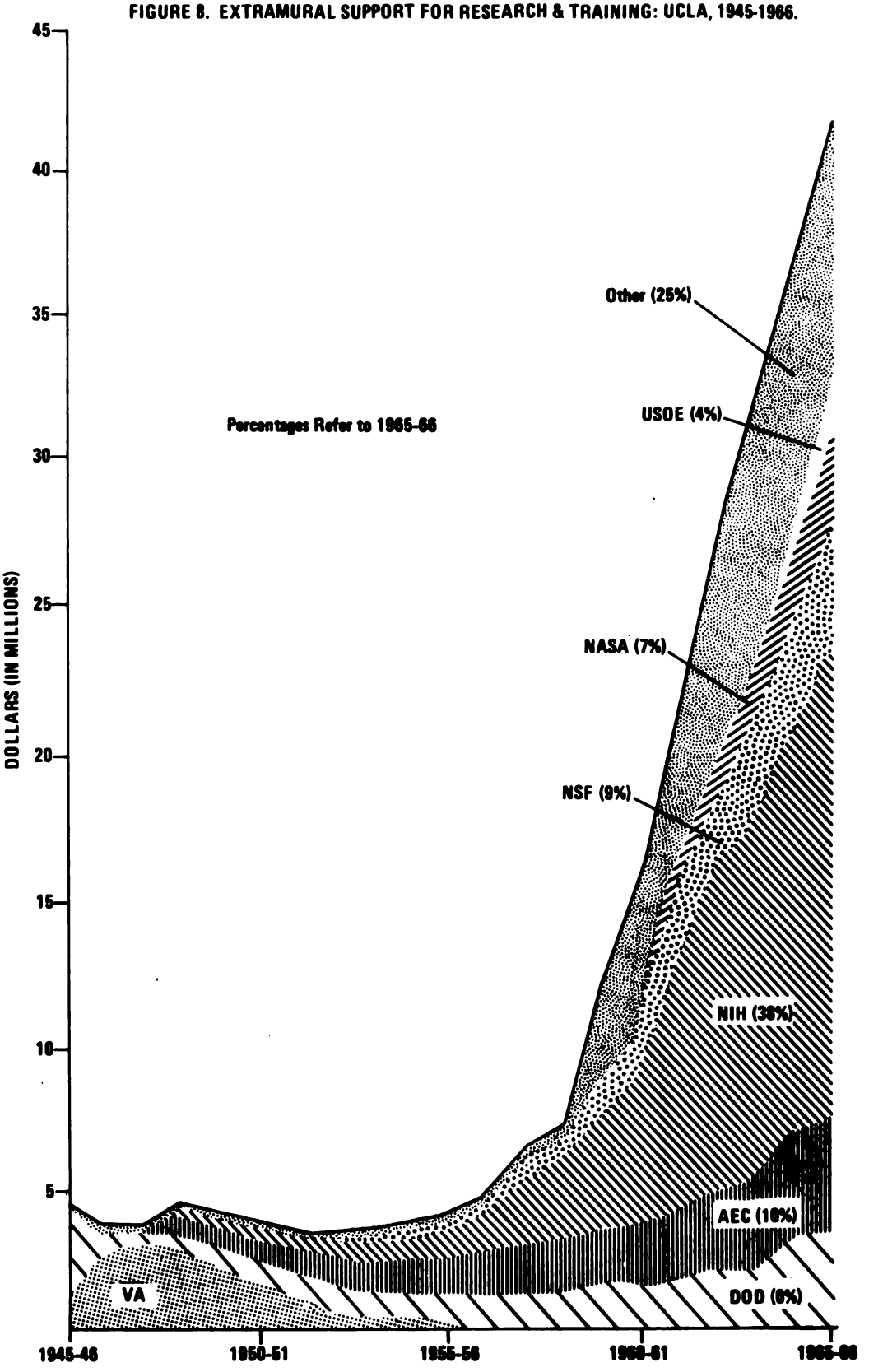


FIGURE 9. SUPPORT FOR RESEARCH: UCLA, 1965-1966

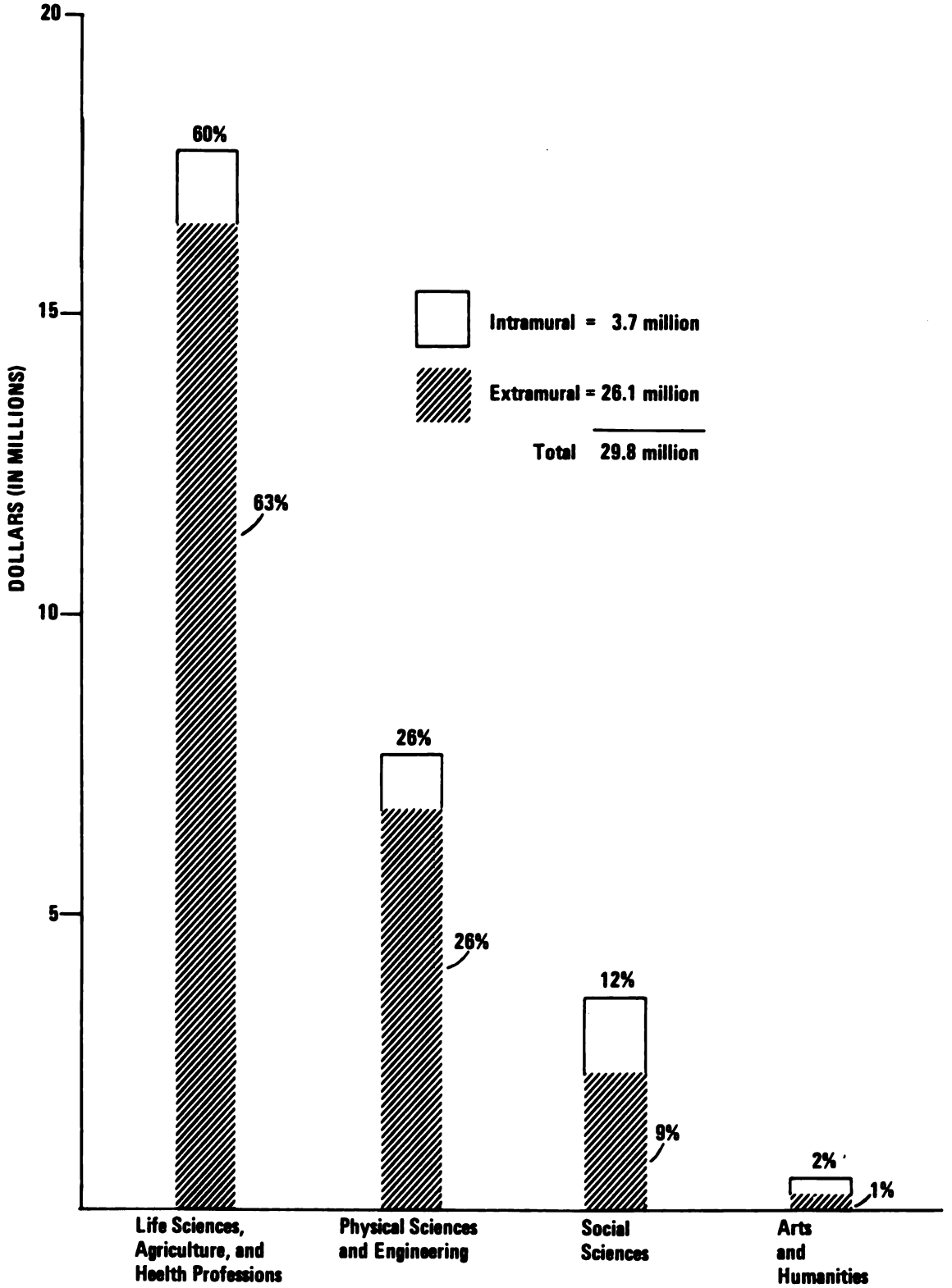


FIGURE 10. POSTDOCTORAL SCHOLARS: UCLA, 1965-1966

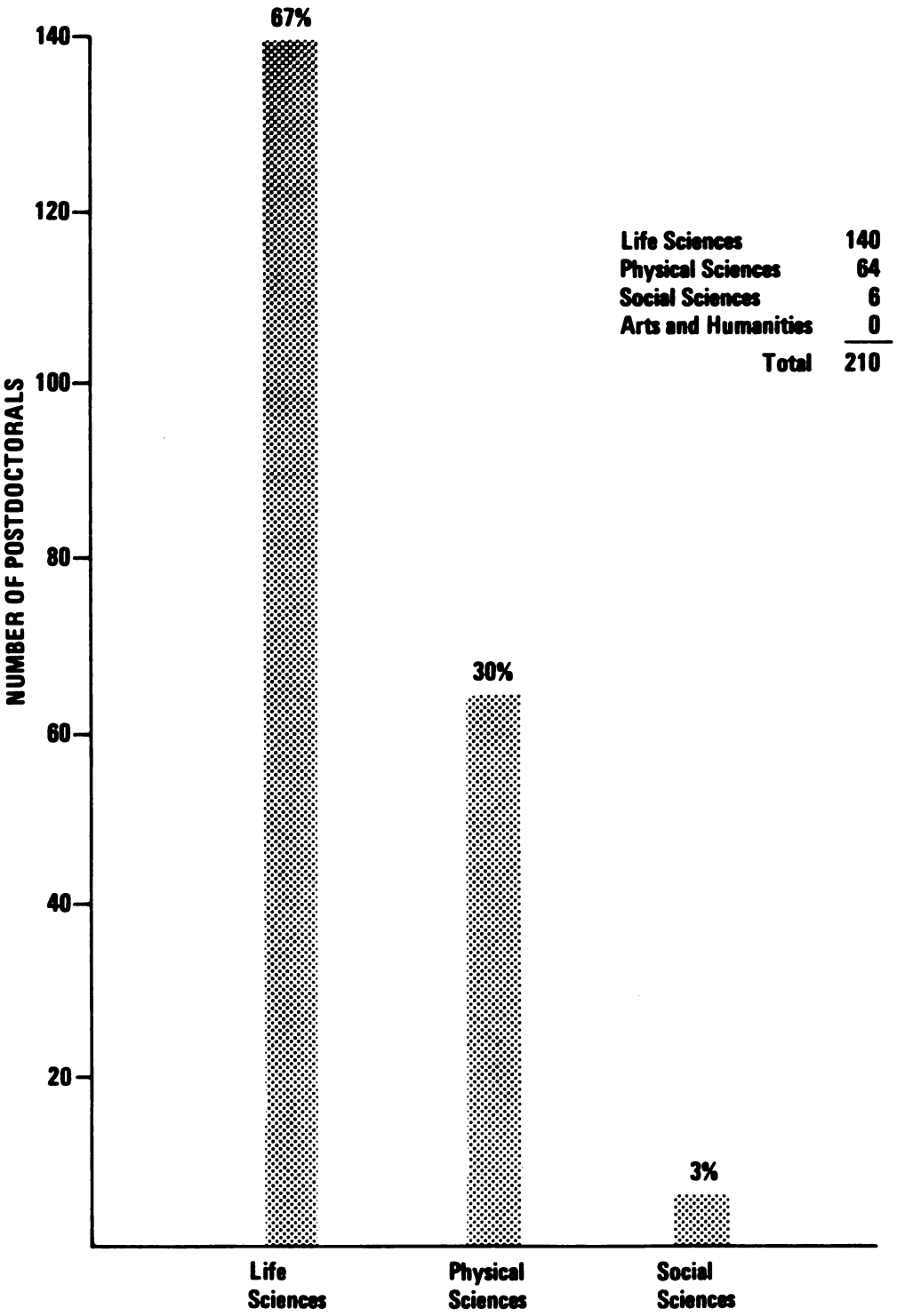


FIGURE 11. PERCENTAGE OF POSTDOCTORALS WORKING WITH FACULTY ACCORDING TO (A) UNIVERSITY APPOINTMENT SERIES AND (B) ACADEMIC RANK: UCLA, WINTER 1966.

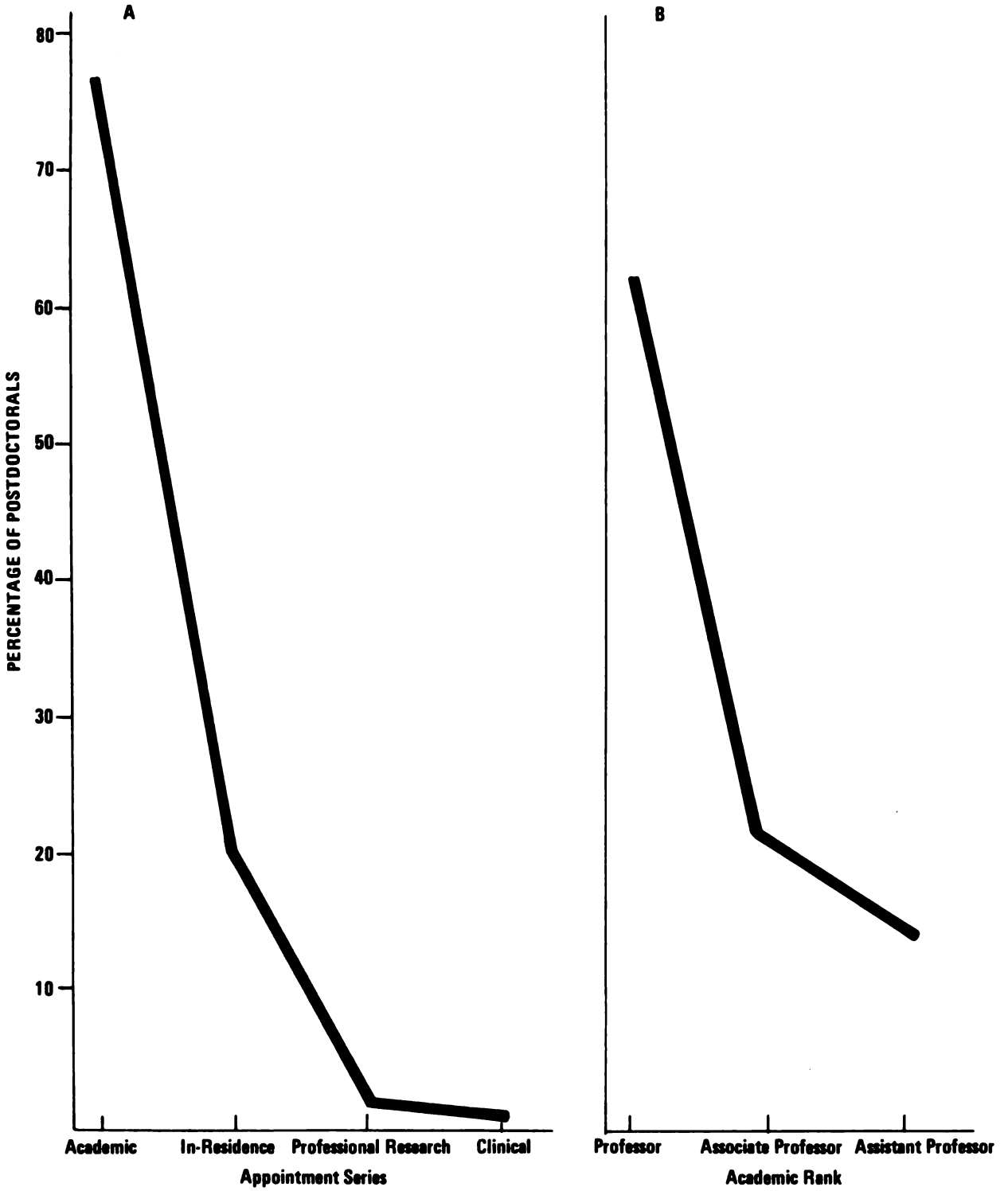
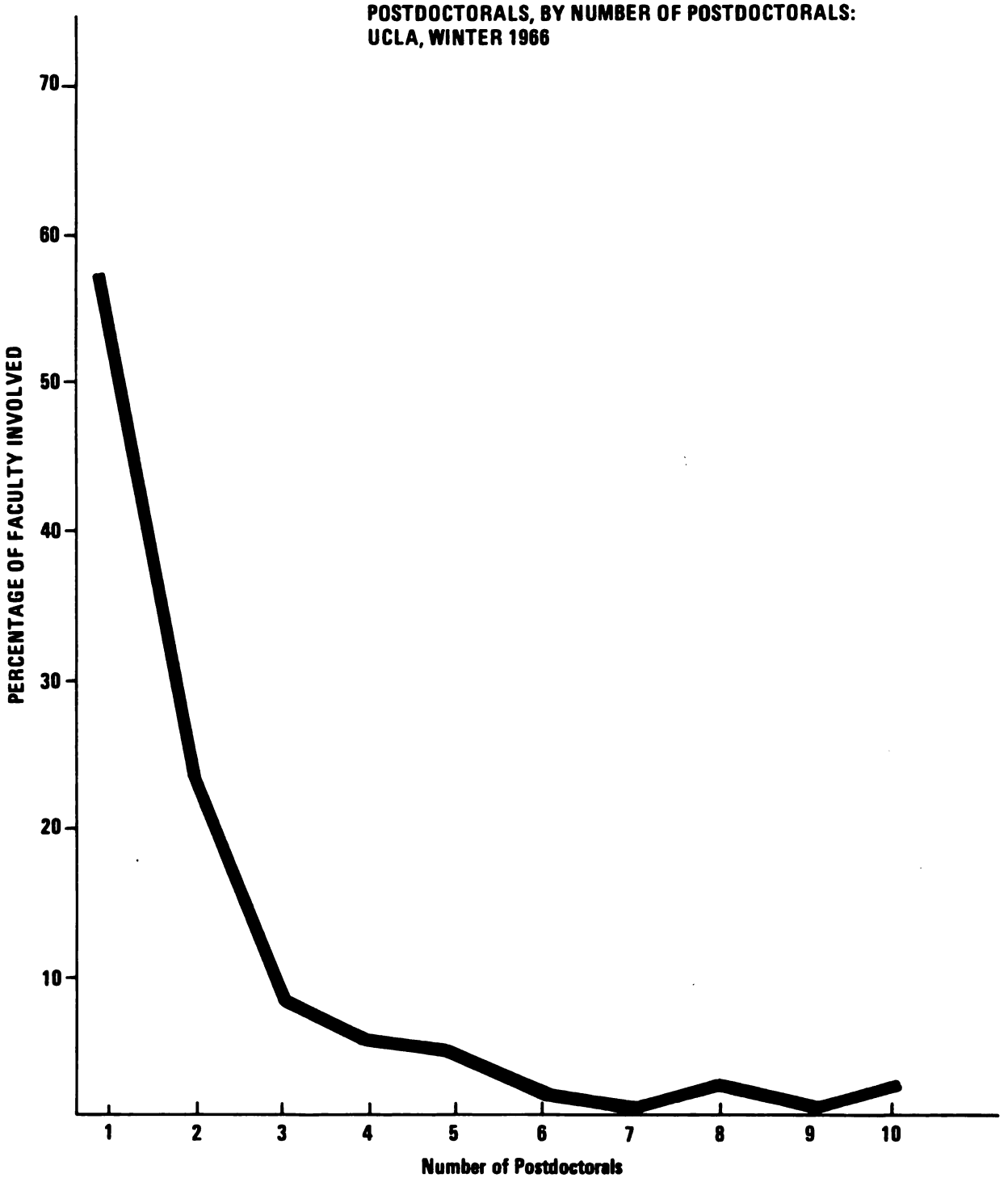


FIGURE 12. PERCENTAGE OF FACULTY ASSOCIATED WITH POSTDOCTORALS, BY NUMBER OF POSTDOCTORALS: UCLA, WINTER 1966



DISCUSSION

Monday morning, September 11, 1967

MR. ARM: (In reference to Mr. Murtaugh's use of Dr. Curtis' data). I seriously question whether the air Force is supporting 241 postdoctoral fellows. I would like to know what definition was used.

DR. CURTIS: They are not fellows. They are anyone who had a postdoctoral appointment, and it would include those appointed on research grants and contracts.

DR. J.H.U. BROWN: (Concerning postdoctorals appointed under research grants). Using NIGMS data we can check something like 2,000 ordinary research grants in which there is about one appointee per grant. If you take the whole 20,000 in the NIH, it adds up to a pretty sizeable number.

MR. MURTAUGH: There has been some discussion as to whether or not provision of stipends in research grants might be useful in making certain that some portions of our training effort are closely associated with a changing, advancing frontier of scientific efforts, as represented by research ideas and research proposals being supported by the research grants process. This is a question that we are debating at the present moment.

The research grant application is perhaps more sensitive to the changing direction of research activities than the training grant application, or indeed, perhaps the fellowship application. The training grant tends to represent or reflect fairly institutionalized departmental interests; whereas the research grant reflects what the changing area of emphasis in scientific activity is.

DR. KRAMER: I am not clear on one point. Under your research contracts and research grants, did you say, Dr. Brown, that you took a count and found there are provisions for about one postdoctoral in each grant?

DR. J.H.U. BROWN: I can't give you the exact proportion of postdoctorals to predoctorals, but let's say one person at some level of graduate education. I would suspect that the average would be something like 60 percent or so postdoctoral, and 40 percent predoctoral.

DR. MAURER: The fellowship to me is not a training program. If a man has obtained a Ph.D. in Chemistry or Physics or Metallurgy, and he still needs training, he should not have gotten his Ph.D.

DR. DONSKER: That is an amazing remark.

DR. MAURER: All right, but I am still making it. It doesn't mean that he is not going to grow in competence and skill, but he should grow in that competence and skill just as he would at Bell Laboratories while performing useful and distinguished research. He has left the academic part of his life where he was a student. He has become a functioning member of society.

DR. ALBERTY: Dr. Maurer, you raised a question which I think is an excellent one and really hits to the heart of the matter. It is the question of what is the real purpose of postdoctoral work and its real nature. I would like to answer that first by quoting some of the survey results from the University of Wisconsin, because I happen to have those right in front of me. They were asked: "What are your main reasons for taking a postdoctoral appointment?" About 47 percent said they wanted to broaden their education, to obtain additional experience, and to learn new methods and techniques. The next 39 percent specifically mentioned the desire to obtain research experience or competence in research. So there we have 86 percent who want to extend their education.

Now, of course, what else could they say? It is really not too surprising. I think it is perhaps more enlightening to look at what they do.

The survey also shows that 42 percent of the postdoctorals took or audited courses. We didn't attempt to make a distinction there, because I think they are past the point of wanting to pay fees and enroll formally, but I have no doubt that some of this auditing of courses was a very serious matter for them. The fact that 42 percent of the 277 postdoctorals at the University of Wisconsin during the winter did this is really quite significant and emphasizes again that it is quite an educational experience.

They were also asked how many actively participated in seminars, and 72 percent of them actively participated in seminars.

Another way I think of seeing whether this is really having an appreciable educational effect is to look at their fields and the department in which they took their postdoctoral work and then their future plans. You can do that from the questionnaire. Of the postdoctorals at the University of Wisconsin, 45 percent of them had their Ph.D.'s in biological sciences, but 79 percent of all these postdoctorals are now doing their postdoctoral work in a department which I would classify as biological science. There is no question about it. There is a much larger number of people in

biological areas at Wisconsin than have their degrees in biological areas. The physical sciences reflect the same figures and the same sort of thing: 28 percent of the postdoctorals said that they had their postdoctoral degrees in physical sciences, but only 18 percent were doing postdoctoral work in physical-science departments.

The last question was: "What will be your primary activity on your future job?" Sixty-one percent said that they would work in the field of both their Ph.D. and postdoctoral appointment. Those people have not changed very much. Twenty-five percent said that they would be going on to their primary activity in their new fields, that is, their postdoctoral fields. Only four percent said that it would be in their Ph.D. research field, and ten percent said it would be in neither. So, I think that a number of these people are undergoing a change of research field through their postdoctoral work. I think postdoctoral work is primarily an educational matter.

I really would hate to see postdoctoral education formalized. I believe the departments should be brought into this area of education to a greater extent, but I would hate to see it be a matter of examination requirements or additional degrees which seem to be very repugnant to me. I would like to see more things done, but I think that as education progresses -- and we are talking really about the highest level of education -- that at least the highest level should be less formalized. I would hate to see the thing become too strict. As a matter of fact, some of the postdoctorals complained that their experiences at the University of Wisconsin were too much like their graduate studies. I would very much like to see the postdoctorals have more connection with undergraduate and graduate teaching in the department or in the university.

DR. CURTIS: I would like to go back to a warning comment I made last night that I am afraid we are forgetting. I am going to rewarn you. I indicated that in postdoctoral education the differences among fields need to be stressed. Comments which we attempt to make across the fields are sometimes extremely misleading. Considering Mr. Murtaugh's and Dr. Maurer's comments this morning, I believe that they were really looking at the postdoctoral problem from two different vantage points -- Mr. Murtaugh in the health sciences, and Dr. Maurer in the physical sciences. I think we have to be free enough to assume that what works in one area may not work in another and that the purposes are different.

DR. J.H.U. BROWN: I am not so sure they are different. I wonder if the difference between the two is not really because one area has specific support in the form of fellowship and training grants and the other area has not received that support.

DR. CURTIS: Let me try to say more precisely what I mean. It depends on the level of abstraction at which one wants to take this. With the large Ph.D. population with which the NIH is concerned, and with the need to build up medical schools in a rather urgent fashion, the approaches that you will take and the role you will give the postdoctorals are different from those in the less-structured postdoctoral situation in the physical sciences. Maybe they outht not to be. Perhaps the physical scientists ought to get together and be concerned about building up colleges and universities, but they have not been.

DR. SANBORN BROWN: This afternoon I am going to report on a survey which we have been carrying out within the organizations of graduate schools to find out how graduate schools view some of these problems. One of the questions which I was not going to talk about this afternoon is precisely the place of education, and I might take a minute to comment about this now.

We sent out some provocative statements and asked the deans to respond to them. One statement that is germane to this was the following: "It is recognized that the first part of graduate education aims at general mastery of a field, and the second part is investigative. The growth of postdoctoral education may indicate either a reaction to a failure of graduate education to provide sufficient opportunity for research, or that the 'publish or perish' syndrome has reached the graduate student level so that he must take a postdoctoral year in order to get enough of a headstart to survive." Then we asked, "Do you agree with either of the assessments, or do you have another of your own? Do you foresee changes which should be made in graduate programs in the light of the influence of postdoctoral education?"

There were 235 responses to this particular statement. As to whether the growth of postdoctoral education is at least partially a result of the failure of graduate education, 20 responses were to the effect that it was a failure and 26 others disagreed with the statement. As to whether the growth of postdoctoral education partly results from growing volumes of knowledge requiring increased time spent in studying, everybody who responded agreed with the statement. However, the greatest response had to do with research incentives. In 74 responses the graduate deans felt that postdoctoral work was just a matter of research incentives. It was a continuation of their Ph.D. research or an opportunity to improve their research experience or an opportunity to work with the established investigators or to expand in new areas.

There were 28 deans who thought the postdoctoral experience increased the professional stature of a person in seeking new positions. The competition for a prestigious position in some fields leads to the raising of hiring standards, so that the experience of these people beyond the Ph.D. was necessary. Twenty-eight said that essentially, although 16 people disagreed with it.

DR. DONSKER: First of all, I couldn't agree more with Dr. Curtis about the dangers of making an across-the-board remark within the field for different universities, because it seems to me that one of the real assets in this country, and I am always impressed with it while travelling abroad, is the diverse character of our graduate schools and research faculties in different universities. I think this is a tremendous asset in any program for postdoctoral education. I think it should be taken into account.

I would like to think in terms of a postdoctoral fellow, because so far we have been looking at postdoctoral education only from the national picture. I have seen several hundred postdoctoral fellows in mathematics here and abroad in the last few years, and I hear about these things from their point of view -- what they want and what is good for them and what sort of environment they seek in American universities and American graduate schools. One of the things that is a tremendous asset, and I think should be taken seriously into account, is that they learn from one another. When you have a place with a sizeable group of postdoctorals in different fields, it is a tremendous way of measuring their education. They learn at least as much from one another as they do from the faculty.

Another thing which I think should not be assumed is that all postdoctoral experiences are positive. There are many that are negative. The benefits depend very much on the willingness of the faculty to take the postdoctoral training aspect very seriously. I would say it is a major endeavor in our place which requires much of our time and energy.

In any school where there is a non-teaching appointee, such persons are really in very close contact with the faculty and with others in their category, and this is excellent. Dr. Maurer this morning was talking about the nationally-selected fellow who comes in and about the the research associate who is somebody working very directly on a research project or in connection with research activities. I think there are some things in between which are characteristic of this country's set-up which is a very positive thing and should be nurtured and, perhaps, specially funded. It helps when you already have the Health Department in with the medical people. In some graduate schools and some institutions, there is a very special, almost magical, research environment. This is tremendously inspiring to young people, and the place selects the people according to that environment.

For example, in our school we go through a tremendously careful selection process. Our committee meets at least five or ten times in the fall going over a long list and selecting very carefully people who will mesh with one another and mesh with the faculty. That is an asset, which a given institution has, that is not present on a national basis. If you pick out schools in a given field which have this very special environment and they know from year to year they will have continuing funding, you create an environment with enormous potential.

I would hate to see any sort of a uniform recipe which would negate that very special positive thing which this country has: special institutions with special characteristics producing an environment which really nurtures and encourages the research output of the people who are involved.

DR. TRYTTEN: How many institutions conscientiously do this sort of thing you are talking about? Can you assume this goes on in very many places? Doesn't it speak for an organization within the institutions specifically dealing with postdoctoral people?

DR. DONSKER: This is true of more and more major universities of America. It is unprecedented. These very distinguished faculties at the postdoctoral level do a much more distinguished job than they do at the graduate level. That is where their interest really lies.

DR. FOSTER: Dr. Donsker, out of your experience with this sort of mutually stimulating seminar, do you have any conclusion as to the best size for such an operation?

DR. DONSKER: We have a faculty of 23. We don't have any undergraduates. We have regularly 50 to 60 postdoctorals, and these people are really taken care of. They don't just sit around. We have 180 full time Ph.D. candidates. We turn out 25 to 30 Ph.D.'s per year, mostly in applied mathematics.

DR. BRAM: I would like to mention in connection with Dr. Donsker's comment that the Postdoctoral Research Associateship Program in Mathematics of the ONR was developed just to emphasize this sort of selection of institutions which might be more beneficial to the associate than some of the top ten.

DR. ALBERTY: Professor Donsker, you are emphasizing something in your comment, and I would like to know if you would go so far as to say that there should not be a national program that would identify the very best?

DR. DONSKER: No.

DR. ALBERTY: There is a very great need for identifying the really very best people and giving them the kind of prestige that only a national fellowship could give them.

DR. DONSKER: I think that in any given year the very best Ph.D.'s in the country do not apply for a general fellowship, but apply directly to those places.

DR. CURTIS: There is a practice among the middle and top institutions of hiring a very spectacular Ph.D. candidate before he reaches the market place and giving him an assistant professorship of an extremely broad variety. The teaching load is reduced essentially to that of a postdoctoral appointment, but with the label of assistant professor. When we start talking about the fellowship, as a means of identifying the

very top in the field, we must remember the very distinct group of people who acquire the title of Assistant Professor right out of graduate school.

DR. MAGOUN: Dr. Donsker, I wonder if we could analyze a little farther the mystical quality you mentioned about the critical mass of distinguished senior investigators, postdoctoral students, and graduate students. One hears the reference to a critical mass as providing a social reinforcement, devotion to advanced research, and concentration toward this goal. Could you characterize further what seems to you to be the essence of this experience and activity? It would seem to me that this was very relevant to the advance of postdoctoral activity or the institutionalization of postdoctoral study.

DR. DONSKER: One essential characteristic is having the mathematics fields connected with the science seminars or research activities of the institution. What is particularly stimulating is that there are seminars involving people from all branches of mathematics. We have something like seven or eight seminars a day in our place.

DR. MAGOUN: Wherever you find an organized research unit, the features that have just been mentioned are present.

DR. SMITH: In the example we have heard, this sense of interaction which one gets is very important, real, substantive, and inspiring. Yet in another place where you might have a whole lot of personnel and a lot of seminars and courses, the interaction does not exist. I think you need some kind of catalyst. One of the things in my training that really stood out was the meetings of the experimental and theoretical physicists from all over. When you have people come in with lists of major accomplishments sitting together and discussing problems together in all kinds of fields and with a great deal of facility, the postdoctoral fellows do learn and do stimulate one another greatly. I don't think you are going to find it by looking in the catalogs or at the reputations of the individuals. It really needs the impetus, the atmosphere, and the environment which makes it so very special.

DR. TRYTTEN: I think you are all aware that there are some pretty important questions here. One is whether a postdoctoral program is justified where a critical mass cannot exist or does not exist, and the second is whether to institutionalize postdoctoral opportunities so that one can help to create this kind of an atmosphere.

DR. CURTIS: An important point here is the commitment of the department or institution to postdoctoral education from the point of view of the postdoctoral. In many research operations --

certainly from the point of view of program officers of the Federal agencies -- there has been a virtual lack of appreciation and lack of concern with what happens to the postdoctoral. I think this has been reflected by the institutions. If we are moving in this direction, the whole question of departmental involvement in this area should be raised.

DR. FOSTER: I want to ask Dr. Smith if he feels this mutual involvement, which is a good thing, is likely to happen to the research associate who in a sense is burdened with the necessity to get on with his own project and who may have a certain guilt about abandoning his post of duty if he gets involved in anybody else's business. Will this have a serious effect?

DR. SMITH: I think it is serious. If you look at it in that way, the postdoctoral associate has an environment like that of the Ph.D: he is required to get a job done in order to qualify. He can't roam very freely, and he can't really even make use of the momentum at this point that he might otherwise have. I had thought of postdoctoral work as giving one at least an opportunity to stray from this.

DR. SANBORN BROWN: May I make one more comment about this study which we have been doing? They were asked to comment on the following statement: "The postdoctoral is probably the loneliest person in the academic community. He knows his faculty sponsor and perhaps a few other members of his sponsor's research group, but, for the most part, he is an anonymous and unconsidered member of the community, identified neither with students nor staff." It is interesting that 11 agreed with that statement. Fourteen deans did not feel that he was quite the loneliest one. The other part of the question was, "Is your institution doing anything to integrate postdoctorals?" And of this, 27 said that they should be, and five said they should not be, but 20 said they were doing nothing about it.

DR. MAURER: I really am bewildered by that reaction of the deans. First, I always thought the deans were the most lonely people in the community, but I was a postdoctoral, and for 20 years I have had postdoctorals working with me. My reaction is that the postdoctorals are very closely integrated into the faculty, that their associations with the faculty members are really of the most intimate character, and that the very nature of the way in which the postdoctoral arrives on campus, and in which he works once on the campus, brings him into daily association with the faculty. The seminars which they attend are one of the normal ways in which they relate themselves to the faculty. I would say that the typical undergraduate is a far lonelier individual than the graduate student or the postdoctoral.

DR.SANBORN BROWN: You must not forget that this is a national study, and it is a national problem. The top 25 universities are a small number of the 163 universities which have postdoctorals. Whether you are talking about that top 25 or not is important.

DR. MAURER: Dr. Smith has raised a point which is of the utmost importance, and I don't see any solution for Dr. Smith's problem where he hinted that the prestigious fellowship might be somewhat of a solution. I really doubt that it would be because the pressure to produce inhibits the young man from the application of his time to expand his views and his understanding of fields which are peripheral to his direct training. It certainly is a very important thing in connection with the postdoctoral.

Ninety-five percent of the postdoctorals, all except those who shouldn't be postdoctorals, are violently engaged in trying to do some research which will enable them to be labeled as distinguished persons. This takes every bit of their time that they can possibly devote to it. This is just the nature of the society in which we are living and in which we work.

When a man gets his Ph.D., he is typically about 27 years old. He wants to get that appointment at Berkeley or MIT, and he wants to get it the only way he knows how -- by recognition as a man with potential in his field. He can only do this by publishing work which labels him as a worthwhile competitor of the men in his field. The fellow is going to be under exactly the same pressures, and it is a very strong man with enormous confidence in himself and a willingness to really run enormous risks who will disperse his efforts in more scholarly activities which do not immediately show up in terms of productive work.

DR. BRAM: I was going to bring up a question that Dean Magoun raised. It seems very important to inquire what can be done or what should be done to stimulate interdisciplinary support of research associates at the beginning level. This is something which is certainly of great concern in mathematics, where there are a number of other disciplines involved.

I am wondering, from the point of view of the Navy Research Program, how best to encourage young people who are trying to get into an interdisciplinary field.

MR. MURTAUGH: I would like to emphasize the force and the power which the administration of substantial sums of money to Federal missions or oriented programs through Federally oriented programs can exert on the university scene. This is particularly

true in a setting where there is a lack of adequate support for the basic academic function. One of the problems which we constantly face is how to maintain the level of quality in the sciences which are supported. The other comment I would like to make concerns the limits of the research role of the university. Dr. Maurer raised the point that indeed the Ph.D. ought to be the ultimate mark of competency and achievement in the field. I don't know, but that seems to me to be a matter of experience. This might suggest that there ought to be some distinction made here in determining what the basic university academic function is. The special additional activity represented by the postdoctoral perhaps should be in some new institutional form along the lines that have been suggested. Maybe we are reaching the point where some new institutional means to house the further growth of scientific and technological activities closely associated with the university scene may have to be developed to provide a more rational basis of progress both in terms of national objectives and integrity of the academic function.

INSTITUTIONAL AND AGENCY POLICIES CONCERNING POSTDOCTORAL APPOINTMENTS

Session III
Monday afternoon, September 11, 1967

We kept on probing and asked, "What changes or new facilities at the University of Wisconsin would make the period of your postdoctoral appointment personally more rewarding and pleasant?" Given an opportunity to reply, 59 percent of them made suggestions. Thirteen percent said there should be improved research facilities and better technical assistance. Ten percent said that they needed improved office space. Other things that were mentioned were salary, houses, better contact between research groups, chances to take courses throughout the University of Wisconsin without fee payments, greater opportunity to teach, easier availability of faculty, and parking.

I started out with this, because I really want to address myself more to the environment of the postdoctoral and their relations to this environment than just purely to the statistics. First we have to understand a little bit better what this group is. I'd like now to concentrate a little bit on the statistics. There are very many more students in the biological sciences, some 261, as compared to less than ten in the physical sciences and only two in the humanities. There were about ten in the social sciences. Fifty percent of these people were younger than 30, which means that they are younger than 50% of the graduates receiving Ph.D's in that year, because the average age at the University of Wisconsin is 30 years. I hasten to say that this is because the average ages are high in the social sciences and humanities, but I want to emphasize that it is still quite a young group. Also, the group that goes to graduate school goes through much faster than average. The national figure for the number of years between baccalaureate and a Ph.D. is 7.3 years, but these postdoctorals at the University of Wisconsin had made it in six. The physical-science average is 6.3, and the University of Wisconsin postdoctorals made it in 5.3. If we look at where they are located within the university, there is a big concentration in biochemistry, which is a very strong graduate training department. The next largest concentration is in veterinary science. There were 13 last year. Many of those people are DVM's and are not quite in the category we are talking about. They are graduates and they are candidates for degrees, but since they have degrees, and since they very often have postdoctoral fellowships, they count in this study as postdoctorals, although some of them are candidates for degrees. We have relatively few postdoctorals in the School of Engineering, seven in total.

As we go down the list, we see an organization which is outside the usual college structure with 37 postdoctorals in the Enzyme Institute being administered by the Graduate School of the University of Wisconsin; it is really primarily a postdoctoral training ground. Some of the faculty people in that organization are members of departments and graduate students and biochemists, but there are some others who are not and specialize in training postdoctorals. As a matter of fact, I think this is a pioneering effort in postdoctoral training, and if you look at the source of these postdoctorals coming into the Enzyme Institute, they come from a very broad spectrum of the field, not just biochemistry. Their record after leaving Wisconsin is really impressive. They have gone out to found many biochemistry departments around the country, and have joined the staff of biochemistry departments all over, but they also have recruited many people into this general field and have not just done this to get them into biochemistry departments. I don't know how many of these 37 are M.D.'s or how many have

M.D.'s, but a certain number of them do have their M.D.'s. They are postdoctorals by our criteria. They actively participate in seminars and in taking some courses, which is a great experience for them. They are not candidates for degrees. After being there two or three years, they will go out and be Assistant Professors, or, in some cases, even Associate Professors, and in very good places.

Chemistry has 25 postdoctorals who are very much involved with graduate training throughout the whole department. The Physics Department has 21, and the same remark will apply. Sociology has five. It is one of the few social science departments which has postdoctorals in it. The Economics Department has only one. The Zoology Department has 11. There again, because of the support of NIH it is not just a traditional zoology department. I am really not very competent to comment on the School of Medicine. I will point out the large number in the Department of Gynecology. This department does not have a graduate program of its own. It participates in the graduate program through a joint effort with the Department of Physiological Chemistry. This is a department that has concentrated on postdoctoral training, and they also recruit people from a very wide variety of sources into it. It is always impressive to see where these people have gone to participate in cancer research all over the country. The School of Pharmacy has 11 postdoctorals, and it is an actively research oriented kind of department.

Skipping on here with the time elapsed from the Ph.D. to the postdoctoral at the University of Wisconsin, we note for 35 percent this period was less than a year. A large number of these people have come to a postdoctoral appointment immediately after their work. Actually 18 percent of them have taken M.D. or Ph.D. degrees at the University of Wisconsin. Fifty percent of them are U.S. citizens, but about 60 percent of them have taken their doctor's degrees in the United States.

With respect to stipends, the average annual salaries were lowest in the biological sciences, averaging $7,300. For the physical sciences, the average was a thousand dollars higher, and for the social sciences and humanities, the average salaries were $1,500 more than for the biological sciences. The small number of individuals involved makes these averages not too meaningful, however. Also, in the social sciences and humanities the postdoctoral is more likely to be a senior person. The postdoctoral trainees and fellows receive significantly lower stipends -- $6,892 and $6,300 respectively -- than the average postdoctoral, who gets around $7,500.

We asked them about the anticipated duration of their appointments, and 51 percent said two years or less. Going on to the nature of the postdoctoral activities, we were very interested in their participation in various educational activities, and I have quoted some of these figures to the group this morning. Of the total population, 72 percent participated in seminars actively, and 42 percent took courses. When this question was asked again, about six or eight months later in the Academy survey, the percentage who were taking regular courses stood up, because I got 42 percent and the survey got 42.6 percent. The Academy study went into more detail on some of these things. For example, in our earlier study we asked how many were involved in the supervision of graduate students, and 33 percent had said they were. In the Academy study we asked them how many were involved in giving graduate-student courses and lectures, and 7.2 percent were.

We asked how many were involved in graduate-student seminars, and 24 percent were. We asked how many were involved in graduate-student laboratories, and 13 percent were. We asked how many were involved in supervising graduate student research and got the figure 17 percent, which is somewhat lower than I had gotten earlier, but I think that it is very difficult to get an accurate answer to this kind of question. Some of the replies indicated that although they saw a good deal of graduate students who were in their laboratories, they had not been asked formally by their professors or their mentors or by the department to take any formal responsibility.

It is pretty obvious that they were actively involved with graduate students, however. Nineteen percent were teaching a regular course, and the Academy study broke this down and found that six percent were teaching in the laboratory, three percent were teaching quiz sections, and eight percent were participating in courses for undergraduates.

You certainly can't just add these figures together, but something like a fourth or a fifth of the students seemed somehow to be involved in classroom and laboratory instruction and credit-type courses. We asked how many wanted to teach more, and in the summer of '67 we got the answer that 17 percent did. In the Academy survey, they got the figure 20 percent, so again that seems to check. It is interesting to see just exactly how we asked the question and how they replied to it. Here it is:"Would you prefer to do more teaching while on the present appointment?" Seventeen percent said yes, 36 percent said it depends, and 48 percent said no. We analyzed this as to whether the postdoctoral was on leave from another institution. Those who were on leave from another institution weren't very anxious to get involved in teaching at the University of Wisconsin, but those who were not on leave from another institution were more likely to be interested and had a higher percentage of yesses.

With respect to career aspirations, 73 percent of them said they were headed for a university; when the Academy survey was made they found 78 percent. Five percent said they were headed for teaching in colleges, and the Academy figure was four percent. So those figures stood up very well. Something like 80 or 82 percent of these people are headed for an academic career, four or five percent to industry, and three to seven percent to government.

We went into their objectives in the kind of jobs they were looking for. They were asked "Will you probably have a job which involves teaching?" Sixty-two percent said yes, compared with 82 percent who said that they were going to universities and colleges. So you see this raises a worry in our mind that these people are so much involved with research that many of them see only aspects of the university which are extremely research-oriented and not very much oriented to the undergraduate problem of the universities. I am sure that many of them would like jobs like those of their senior professors, and they think of teaching as being part of his job. We asked them then, "What level of students will you probably teach?", giving them a choice of undergraduates only, graduates, and so on. Nine percent said that they would be teaching undergraduates only. Maybe that isn't too surprising, but it indicates a leaning away from undergraduates. Sixty-six percent thought that they would be teaching graduates and undergraduates, and 25 percent said that they would be teaching graduate students only.

I guess I am revealing my own prejudices in the matter. I would really like to see people teach at both of these levels, and not restrict their attention to just one of them, but here we have 25 percent of these people who say that they want to teach only graduate students.

This brings me around to the main point of the philosophy that I would like to bring up in connection with the postdoctorals. I think that we don't necessarily do the best thing by them in completely isolating them from teaching activities. They often learn from teaching experiences things that will help them in their own fields. I think that some participation in teaching will always bring them into contact with other people in the department.

Our respondents were asked how many staff members they came into contact with and also how many staff members they had significant professional contact with. Twenty-one percent said one staff member, 17 percent said two, and 16 percent said three. So we can say half of them said they had significant professional contact with three or more.

There are many places in the university where they do not have very much contact. I think this is something to worry about. Mr. Maurer presented one kind of picture this morning when he mentioned that the students at Illinois were integrated into departments. I would just like to present the other extreme in this situation. It is possible for a postdoctoral to correspond with a professor who will rate him and say, "Sure, we would like to have you. Come join our group and be a research associate." The rest of the department does not know who this man is. When the wives get together and talk about having a tea or reception for the department, they have never heard of him or his wife. Unless something is done by the professor, by the fellow, or by the staff, he may be very isolated -- very much more so than a graduate student who gets around and gets involved in that way. So this postdoctoral may revolve around this one professor and not really see very much of the other research activities in the department and not really get to know anybody, even though he is there for a couple of years. He gets to feel he is not a part of the system. I had a couple of very bitter letters from postdoctorals at Wisconsin while I was undertaking the survey pointing out that no one had really done anything to make them feel welcome or to get acquainted with them and that they felt extremely isolated, and that they were indeed very unhappy.

There are a lot of things that can be done, and most places are doing them. Maybe it is wrong to suggest that if these people are just involved in teaching this would occur itself. It is one of the ways they can be brought in where their experience would be useful and where they would get an idea of what the university is -- that it is more than just a research institute. So when they went out to the academic job which is so inviting to many of them, they would be more interested in the formal educational activities in the department.

If postdoctorals are to have more status -- perhaps faculty status, although I think we don't need to worry too much about the terminology -- I think the university has to become involved a little bit more. This idea is repugnant to a number of professors who feel that they have the money and the space and they can hire postdoctorals and manage them as they want to, but I think that universities should be encouraged to move in the direction of greater involvement. The departments will play a big role in the process, and the department should look at the postdoctoral as a part of its responsibility, and not just the individual professor's responsibility.

POSTDOCTORAL FELLOWSHIPS FROM THE UNIVERSITY VIEWPOINT

Sanborn C. Brown

What I would like to report on is a study which has been carried out for the Association of Graduate Schools and the Council of Graduate Schools, in cooperation with the Curtis Study. It is an attempt to find out how graduate deans themselves feel about some of these problems of postdoctoral education.

We chose 163 universities which we knew had postdoctorals on their campuses. We knew it in two ways. As you are aware, the NSF traineeship proposals which were submitted by the universities this past year called for a report of the number of postdoctorals. We were fortunate enough to get a computer print-out of those institutions. We also had NIH statistics, which were provided by Dr. Rosenberg, on the distribution of the postdoctoral population.

Of the institutions that we knew had postdoctorals on their campuses, 79 actually responded. This does not include a fairly large number who said they did not have any postdoctorals. We wrote back and said, "Yes, you do." Some of them didn't answer us after that.

Some of the deans expressed more than one opinion in answers to the questions. The number of answers to each question does not mean the number of deans who responded, but was the number of responses. Let me go through the replies that seem to me to be germane to the subject of this meeting.

The first question deals with postdoctoral education and the quality of institutions: "Many faculty members now believe that a department cannot achieve the highest quality without postdoctorals. Even if a department does not offer a postdoctoral program, the presence of postdoctorals is vital to the faculty. Do you agree with this position, and what are you doing about it at your institution?" Thirty-six deans said that the presence of postdoctorals was vital to the quality of a graduate department, and against that, 28 said it was not vital. On the other hand, 30 said it was a very important factor which stimulated the faculty and brought points of view about their own programs from other Ph.D. schools, enhanced the faculty reputation and research programs, and aided in setting up new departments. We also found a fair number of people, 16 as a matter of fact, who said that postdoctorals are attracted to a department that is of high quality, and therefore tended to concentrate in places of high quality. Let me read one dean's answer, which actually comes from Dean Miller of the Graduate School at Yale: "Postdoctoral students naturally apply to departments of high quality, and institutions of high quality wish to admit some postdoctorals. I must confess some scepticism of a department which has sufficient quality to attract worthwhile postdoctorals, but does not have the quality to mount a good doctoral program. This suggests that there is a professor or two with whom the postdoctoral wishes to work, but not a critical mass necessary for the offering of the doctoral program. I do not believe, though, such circumstances are very frequent."

On the other hand, a fair number of institutions -- I am not talking about M.I.T. -- throughout the country wrote essentially that the postdoctorals were very good for the prestige of good departments. Typical

of this kind of answer was that from Dartmouth College, which is a small institution just beginning programs in the experimental sciences and health: "Research activities necessary for the department generally cannot be maintained by the solitary activity of the professor in the laboratory. In the absence of the graduate student, the participation of undergraduate research helps, but usually technicians or postdoctorals are required. The biological sciences tend toward technicians, whereas the physical sciences tend toward postdoctorals. Such activity has preceded the establishment of Ph.D. programs in our science department."

The deans were also asked if there were plans for increases or decreases in postdoctoral activities. Sixteen said that they would increase them if possible, and ten said that they had no plans one way or the other. Five said that they would not encourage postdoctoral study, because other activities of the department take precedence.

Another question had to do with the competition between postdoctoral students and graduate students: "In many places there is obvious competition between graduate and postdoctoral students. It is said that one postdoctoral replaces two or three graduate students. In trying to justify the balance between the two groups, opposing points of view are evident. In one group of institutions postdoctorals are considered to increase the capacity for graduate students, and in other groups the postdoctorals are considered freeloaders who do nothing for the university community and its scholars. In fact, they have a negative effect of further insulating the graduate student from faculty. How do you justify the balance at your institutions between the two groups, postdoctoral and graduate students?"

Of 207 responses, 38 said there was no competition between the two. Fifteen said that if competition arose they would curb the postdoctorals. In essence, a number of people said that the two groups were in competition for space and funds. This worried them, but then they went on to talk about the benefits and the disadvantages involved.

Forty-six deans felt that there was a benefit in having postdoctorals at the institutions, particularly since they extended the faculty by assisting graduate students through informal contacts, and, of course, they stimulated the research programs. Fourteen deans went to some length to give the disadvantages. This is like Bob Alberty's list of disadvantages. Let me indicate a few of them: the postdoctorals insulate graduate students from the faculty, they take away the importance of the Ph.D.; they are not fully integrated into the institution as they are attached to a specific senior professor; they are freeloaders in that they receive no degrees and pay no fees and have no required non-research duties; they avoid the reality of earning their own way in the academic world; and they are really low-paid employees.

On the other hand, about the same number of people said that they felt there was a balance here which they were perfectly willing to live with.

Another question had to do with teaching: "Most Ph.D.'s are oriented toward a three-prong academic year, including teaching, research, and administration. Although the research training may be excellent, universities are criticized for turning out both graduate students and postdoctorals with little background in the reality of teaching or administration.

There have been programs to develop the background of postdoctorals in the area of teaching, administration, and research, but most universities take a laissez faire approach and have no definite policy in this regard. Do you feel there is a problem in the lack of attention to teaching and administrative experience? Do you have any specific suggestions or programs for preparation of postdoctorals in these areas?"

Here the deans felt in general that there was a lack of attention to providing teaching experience. As a matter of fact, 65 deans wrote in various degrees of completeness about this lack of experience. A number of people suggested that when one has contact with fund-giving agencies it should be pointed out that teaching should at least not be discouraged in the appointment of postdoctoral people. We also asked about administrative experience, and the answers turned out to be very interesting. A fairly large number of deans pointed out that there should not be training in administration, although there should be some experience of teaching. We have analyzed these replies very briefly by finding the age of the deans who answered in this way, and it is very clear that those deans who are young and have come up to the modern era of spending a large amount of time in raising money and doing administrative business rather than research answered that the postdoctorals should help in the administration because this is part of the real life of research at the present time. The older deans who did not have to go through this experience felt that it had nothing whatever to do with the postdoctoral's experience. In this regard, let me summarize by reading the reply of the Dean at the University of Iowa: "There is a considerable division of faculty attitude about this question. There are those who feel that postdoctoral training should be exclusively oriented to research, partly because of the conviction that research should be the exclusive interest of the postdoctoral and partly because of the conviction that the best training for teaching is the development of a thorough understanding of subject matter through research. Of an opposite view are those who feel that postdoctorals should be involved in all aspects of the operation of the department. There is considerable sentiment for the inclusion of some teaching experience for the postdoctorals, but little sentiment for the inclusion of administrative experience. My own view is that we should do a better job of training our predoctorals and that the postdoctoral program should be primarily concerned with the development of investigative skills. However, persons who are on the frontiers of new knowledge and who are achieving new insights in their field as postdoctorals presumably should be given the opportunity to develop concurrent skills in the effective communication of new knowledge to others."

Two more questions which I will touch on today have to do with the complicated matter of balance of costs and benefits. The question read as follows: "Depending on the argument one wishes to make at the time, one is ready to say that support of postdoctoral education is very costly and alternately that it offers great benefit to the post institution. Most institutions have charged tuition fees to degree candidates and have thought of charging a postdoctoral fee. Admitting that the costs and benefits are extremely hard to measure, how would you balance the costs and benefits at your institution?"

This is a complicated problem for the study committee working with Dick Curtis, and, as a matter of fact, we have set up a subcommittee under President Jones of the University of South Carolina to look specifically into this problem.

Before I tell you the answers of the deans, I should point out that most fellowships do not carry a cost allowance anything nearly like research-associate overhead costs. Most university administrators feel that the overhead costs are real costs, and therefore unless the university gets sums equivalent to the overhead on the research contracts for research associates, the fellowships are costing the university a lot in money. The answers I want to talk about, however, are not so much the money as the benefits which the university gets.

Thirty-seven deans went to some length to discuss the benefits, which included institutional prestige, better research programs, substitute faculty, increased ability to obtain leading scholars on the faculty, and the strengthening of educational training. In the matter of costs, 19 deans commented about the financial loss to the university of the postdoctoral educational program and either felt that a fee should be charged or said that they were presently charging a fee -- one equivalent to that for graduate education. On balance, however, taking all the replies together, about as many felt that the benefits outweighed the costs as felt the costs outweighed the benefits.

Let me read you some short comments about this. From Ohio University: "Since our research requirements are compelling, we feel that the cost of postdoctoral education must be accepted regardless of the amount. We do not charge a postdoctoral fee, but we do register them with the waiver of tuition for a full load of research, and thus obtain State support on the basis of this registration." So they felt pretty happy about it.

Again let me quote from Yale: "Postdoctoral students do bring both costs and benefits to the university. I doubt that most universities have any sense of what the relative magnitudes are. However, if the training component is an important part of postdoctoral experience, I am sure that the costs outweigh the benefits. At Yale the Corporation has established a fee for postdoctoral fellows equal to the tuition for a full-time graduate student with the proviso that the Dean may waive all or part of this at his discretion, and a certain portion of this may be given to the department for special research expenses. While I have had to waive a fee in a number of cases, we have pushed the granting agency on this issue. There is no question in my mind that the costs outweigh the clear benefits to the institution as against the benefits to society."

Finally, from the University of Pittsburgh: "I believe the benefits outweigh the costs, though the costs are substantial unfortunately. However, the costs are in dollars, whereas the benefits are in intangibles which can't be used to pay bills. The question an institution must face, therefore, is what quantity of benefits that come from postdoctorals' involvement it can afford to buy out of the funds it has at its disposal. Since postdoctoral work is a losing proposition from the dollar standpoint, the extent of any institution commitment to postdoctoral education will have to be determined by budgetary considerations, and this is true at the University of Pittsburgh."

I would also like to share with you some of the comments about the following statement on the formalization of postdoctoral selection and training: "Although a few institutions have formalized their procedures for postdoctorals, most institutions have found their way clear because their individual faculty members were willing to have them. No one else screens their qualifications, and no one else reviews their progress in any way or their presence in the university community. Usually no one in the administration knows how many there are, how well qualified they are, or how long they will stay. What controls do you have or do you think you should have?" Here I must point out that there is quite a difference between an administrator's point of view and the point of view that Professor Maurer was talking about this morning. In general, deans look at this type of population as not going through the rigorous screening that a younger faculty member would have, and, therefore, in most institutions, postdoctorals are not considered part of the institution. In this respect, what is happening, according to about a third of the deans reporting, is that the individual faculty have complete control. Another third said that the department or department chairman had the control, and another third said that either a dean or a vice president or some other administrative officer had some control. In connection with Dr. Maurer's point -- I don't really want to put him on the spot -- his dean said: "The arrangements for postdoctorals are informal. Their presence and control should be in the hands of the department, but unfortunately it is usually in the hands of the executive officer of the department in question." Whether that means anything or not, I don't know. In terms of the department's feeling about control, as you might expect, they would like a lot more control.

Sixty-four deans wrote in to say that they were going to try hard to get some more control than they now have. Typical of the answer that one usually gets is that from Peter Elder at Harvard, who says: "I must confess that I know almost nothing about postdoctoral students, except we have a large number."

Let me end, however, by reading a quotation from the Dean at the University of Miami: "I do not know how many we have, because they come upon the invitation of individual faculty or departments. As you know, no group screens them, and no one reports their presence. I find out about them more or less by accident or by happenstance of reviewing budgets. I do not believe there should be any selection process higher than the department in the program that will work, but I do think that for the sake of graduate education, the quantity in a department or program should be controlled by the graduate school in relation to the work needs of a given department or program. Furthermore, the mere presence of funds to support them should not be the determinant of their length of stay. After all, they have to stand on their own feet some day and justify the years and expenses. Frankly, a certain number of postdoctorals with whom I have been acquainted have been bright enough, but emotionally too weak to cut the academic umbilical cord. Unless a reasonable time limit is set, we may have today some of the problems with postdoctorals that we are supposed to have now with the doctorates in the humanities and social sciences. We may even give postdoctorals ample subsistence for their grandchildren as a candidate in his family."

A LOOK AT UNIVERSITIES BY A FELLOWSHIP-GRANTING AGENCY

Howard D. Kramer

When I was asked to say a few words about universities and their relationships with postdoctoral fellows, my inclination was to beg off. Despite my years with the Foundation, my knowledge on this particular subject is very limited, but I finally agreed and hoped in preparing these remarks to dispel my ignorance.

I can't report much success.

One of the first things I did was to do some library research to see what others had said or were saying about postdoctorals on campuses. I consulted the Reader's Guide for the most recent volumes, which took me back to 1960. Not once was there an entry under the heading "Postdoctoral." The index almost invariably went from "Postcard" to "Post Mortem." Also, looking under various other headings, such as "University Education," "Higher Education," and others for those possibly dealing with postdoctoral training, I found nothing. Obviously I had the wrong guide.

I next turned to the Educational Index, and here I finally came upon an entry on postdoctoral education. It was under a major heading for scholarships and fellowships, and it referred me to the December 1963 issue of "School and Society." This article turned out to be two short paragraphs containing the notice of the 1963 award of the NIH postdoctoral fellowship competition.

I really wasn't surprised about how little appeared to have been written about postdoctoral study. It has been our practice at the Foundation to have regional meetings with NSF coordinating officials. The majority of these officials, as you probably know, are deans of graduate schools. In 1962, we placed on the agenda a discussion of postdoctorals and asked the participants, who represented about 180 institutions, to bring with them figures on how many postdoctorals were currently affiliated with their institutions. A few of us on the Foundation staff thought we would be able to summarize the responses and get a reputable total to be used as back-up information for Congressional hearings. We were soon disabused of that notion. Almost without exception the coordinating officials admitted they didn't know the number of postdoctorals on their campuses and confessed further that they weren't sure that they could find out as things then stood.

A spin-off of this request of ours about which we heard later involved a graduate dean who stumbled into it and then stumbled out of it quickly. The chemistry department at his institution -- a fairly large private institution -- appealed for more laboratory and office space. By head count of the faculty and graduate students, there should have been plenty. Investigation showed the crowded conditions were due to the large number of postdoctorals, of which the administration had been unaware until then.

Another example along this same line. A week or so ago, we were informed that a graduate dean had stood up in a public meeting recently and confessed that he not only didn't know how many postdoctorals there were at his institution, but he was not even sure how many departments there were.

A look at the universities by National Science Foundation at the postdoctoral level is not as searching as I had hoped we could direct to the university at the graduate-student level. However, we have had some opportunity to become acquainted with postdoctoral education at institutions with which our fellows are affiliated.

We have been awarding postdoctoral fellowships since 1952. In numbers up to the present, the Foundation has supported about 2,100(regular) postdoctoral fellows, about 925 senior postdoctoral fellows, and close to 3,300 science faculty fellows. Having given you these figures, I must immediately refine them further for you. In our postdoctoral program, which caters to the younger scientist, about 45 percent chose to study overseas. I gather at this meeting we are not vitally interested in our relations with foreign universities, and, in fact, I couldn't tell you much about them anyway. Thus over a period of 15 years, we have had less than 1,200 fellows affiliated with United States institutions in the postdoctoral programs. In addition, it should be noted that a considerable proportion of these postdoctoral fellowships were held at non-university locations such as the Institute for Advanced Study and others.

I would call your attention to the fact that NIH awards close to 1,200 postdoctoral fellowships annually, just to put the NSF support of young postdoctorals in proper perspective. I think in NIH there should be about 6,700 who went overseas in this category.

As I mentioned, there have been nearly 3,300 NSF faculty fellows. Only about 800 of these fellows were postdoctorals. Of these, some went abroad.

In summary, I would say that over 15 years we have had less than 2,000 postdoctoral fellows in these three categories studying at U.S. institutions. I also believe this is a smaller number than you have heard in recitals of figures.

Seldom do we have direct communication with the university administration about postdoctoral awards. After all, it is our view that a postdoctoral by this time should be responsible for making his own arrangements with his scientific sponsor and the fellowship institution. Many years ago, we did prepare and distribute a brochure entitled "Information for Institutional Sponsors of an NSF Postdoctoral Fellow." The greatest difficulty in preparing this booklet was finding enough to put in it. A large part of the text consisted of statements asking the parties concerned to please be kind to each other.

Periodically a member of the NSF staff pulls together a collection of statements about administrative matters. In these reports -- I reviewed a collection before coming here -- the complaint most often heard is that of lack of space. One fellow said the school should be compelled to provide space at least comparable to that provided a graduate teaching assistant. Another stated NSF should stop the university from profiteering; he never got any space at all. One fellow urged us to do research so that "general models might evolve regarding the status and role of a postdoctoral fellow in terms of his relationship to the fellowship institution." More often than not those commenting on administrative matters thought the NSF should give the institutional allowance directly to the department rather than to the institution itself. One fellow said there was a lack of communication con-

cerning the fellowship within the university administration. These are just a handful of comments from complainers. Most of the comments didn't go into these matters at all.

The comments, in fact, were much more severe with NSF than with the fellowship institution. One wanted us to issue record stubs with the paycheck as an aid to the fellow in preparing his income tax form. Another thought we should charter airplanes each summer to take our fellows to Europe and bring back those that were there. Still another said we should pay for the expense of commuting home on weekends. Actually, the number of complaints is small, and it is hard for me to detect in these final reports any serious problem in the manner in which the university deals with the postdoctoral fellows.

There are two matters about which the Foundation has had direct conversations with the administrations of institutions which accept NSF postdoctorals. The first is the institutional allowance now provided in regular postdoctoral and science faculty programs, and the second is the supplementation of fixed stipends of the regular NSF postdoctoral fellows. We offer to the United States institutions, in the regular postdoctoral and postdoctoral science faculty programs, an institutional allowance of $1,000 for each 12-month tenure. Parts of this allowance were used as a special fund against which the fellow could draw for supplies, equipment, and so forth. This special allowance, however, provided no real recompense to the university for space and other facilities. A few universities called this to the Foundation's attention. They easily proved that they had out-of-pocket expenses. There is no question that in some sciences this institutional allowance of $1,000 does not cover the expense of having a regular NSF postdoctoral fellow on the premises. In other sciences it appears to be more than enough. At present, the universities are expressing no strong dissatisfaction with the amount.

The supplementation of the stipend in the regular NSF postdoctoral program has always been and still is a hot issue. This year we changed the guidelines to permit a fellow to accept a limited amount of remuneration for a limited amount of teaching. Immediately we began receiving requests for permission to supplement postdoctoral stipends from institutions where no teaching opportunities were available. We are now handling these requests on a case basis, but, in general, are permitting limited amounts of supplementation at such locations.

There is an awkward aspect to this situation. As the Foundation moves toward a more lenient attitude with respect to supplementation of postdoctoral stipends, NIH has reiterated a bit more positively than previously the disapproval of stipend supplementation. The Foundation supports a large number of postdoctoral appointments by means other than fellowships. Although I have been asked to confine my remarks mostly to postdoctoral fellowships, there are some interesting facets to these other types of Foundation support I would like to mention. Through research grants, as you know, we provide funds for postdoctoral research associates. The variations in such support by discipline are very curious and pronounced. In research grants for chemistry projects, the budget almost always has a provision for hiring of postdoctoral students. In many chemistry departments there are more postdoctorals than faculty members. The most recent figure I have for the chemistry department at Harvard was 30 faculty and 90 post-

doctorals. The ratio of postdoctorals to faculty in chemistry departments is almost always at least a one to one ratio. Physics has a lower ratio, but also utilizes an appreciable number of postdoctorals. When making research grants in this area, the NSF makes no attempt to learn the names or pedigrees of the persons to be supported as research associates.

In the social sciences the situation is quite different. The social sciences proposals contain an item for postdoctoral support. When such a proposal does occur, the staff requests the name and pedigree of the person to be appointed before approving the budget item.

In some areas of the life sciences there is the same insistence on knowing who is going to be appointed. Here the reason is different, however. We ask for more exact information in order to be sure that the postdoctoral investigator does have a candidate in mind and has a high probability of getting him, so that the funds granted for this person will be used and not lie fallow.

In mathematics there are still other problems. The usual requests are for half-time research support of a person to be added to the staff of a department as an assistant professor who then teaches half time and gets paid by the university.

As project research support has grown in volume, each university in its own way has set up a board for reviewing research proposals before they are submitted to the agencies. The result has been a more stabilized system in the asking price for research associates. As an example, the California State University Hospital System, I have been informed, has established a salary schedule for postdoctorals with grades and steps much like that of the Federal service. To me this is a piece of evidence showing that there is an increasing amount of recognition of the importance of postdoctorals. These junior faculty members in the academic structure are needed, and their recognition is increasing.

Another means by which the Foundation supports postdoctorals at a university is through our institutional scientific development and departmental science development programs. For instance, in the budgets of awards to university science departments, made by the Foundation in the past few years, you would see there has been about $5 million dollars granted for the support of postdoctorals. So for purpose of comparison, let me mention that the annual budget for the NSF postdoctoral fellowships in the past few years has been in the neighborhood of the $1 million-dollar level. I offer this as evidence that the university looks upon the growth in numbers of postdoctorals and their work as vital and essential to the health and well-being of the institution -- certainly of the department involved.

In conducting the NSF Graduate Traineeship Program last year, we requested departments wishing to apply to fill out what we call a departmental data sheet. A summary of the data obtained from 2,861 science departments can be found in Section 10 of the Source Book which Bill Kelly has provided. The collected data have been very useful to the Foundation in giving us a better and more accurate picture of the support of graduate students. However, we did not neglect the postdoctorals altogether, as Item 9 in the sheet indicates. We are getting some interesting information from these sheets.

I have a few figures on field distribution of postdoctorals which, while not unexpected, point up significant differences among various fields. Let me read a few of these. For biology, the number of full-time graduate students is 4,206. Remember now, this is the population here in general. Considerably more than 90 percent of the departments responded. Faculty members in biology numbered 1,434, and postdoctorals and research associates reported were 524. For psychology, without clinical psychology, full-time graduate students were 9,516; faculty members, 2,331; and postdoctorals and research associates reported were 164. In engineering, full-time graduate students were 26,816; faculty members, 7,847, and postdoctorals and research associates, 668. Mathematics graduate students number 9,076; faculty members, 3,082; and postdoctorals and research associates, 149. Chemistry full-time graduate students were 12,191; faculty members, 3,132; and postdoctorals, 1,756. Physics graduate students were 10,917; faculty members, 3,312; and postdoctorals and research associates, 1,059. In economics full-time graduate students were 5,725; faculty members were 1,613; and postdoctorals and research associates, 70. In political science, there were 5,418 full-time graduate students; faculty members, 1,313; and postdoctorals and research associates reported were 11. Finally, sociology graduate students numbered 2,921; faculty members, 780; and postdoctorals and research associates, 32.

Next year we plan to go after a little more information about postdoctorals from each department. We are asking how many postdoctorals are doing some teaching, and how many have received Ph.D.'s since 1963. The Academy's Postdoctoral Study now under way will, of course, get us much more information and much more detailed information, but it is a one-time collection of information at a point in time.

The information we hope to get year after year will prove useful in denoting changes and trends, and hopefully will have a value of its own.

In closing, may I make one suggestion directed mainly at Dick Curtis. Out of your study will come many articles and papers. Let me urge you to urge all of your schools to select titles which have as the first word "Postdoctoral" to be located between "Postcard" and "Post Mortem" in the Reader's Guide.

SPECIAL PROBLEMS OF THE NATIONALLY-SPONSORED RESEARCH ASSOCIATE

Lloyd Smith

I have been asked to talk specifically about the postdoctoral associateships that were mentioned last night by Joe Boyce. These, as you know, are sponsored essentially by various government laboratories and agencies, but the selection of the postdoctoral associates themselves is made by the National Research Council. The National Bureau of Standards was the first government laboratory to take part in the program.

I would like to say at the outset that there are some problems in general with the program. I think they are sufficiently tangible to get a pretty good hold on, and I hope that what I have to say about them will be fairly well and clearly brought out.

The information that I have acquired about this program has come through inspection tours through the participating government laboratories. In these visits, I had an opportunity to talk to the management of the laboratories, in some cases the scientific management, and in all cases the scientific staff. There were some cases where there was military management of the laboratory. I also talked to some 60 of the postdoctoral associates, most of whom were actively participating then. I talked also to people who had gone through the programs and were either regular employees of the particular laboratory or, in some cases, had transferred from one laboratory to another. In other cases, I spoke to people who were neither in a government laboratory nor in one of the participating laboratories, but who had gone from there into a university or industry.

All of the government laboratories that I have talked to felt that this was a very valuable program for them. You can see the benefits in these laboratory programs. In general, most of the postdoctoral associates felt reasonably satisfied with this opportunity. I will speak a little bit more in detail about these subjects in a minute. So I think that there is no question about the value of the program.

I would like to discuss some of the good and bad points without mention of where improvement can be made and where, in some cases, there are difficulties. One of the big problems is that everybody expects that this can only be a good program if it includes the National Academy of Sciences. The standards of performance and the professional status of the laboratory must be maintained. This is a particularly important question because as the benefits of such a program have developed and have been recognized in the participating laboratories, there has been some stress on the National Research Council to include other laboratories in the program. In addition to the laboratories that were participating, I also visited some that weren't on the list and that wished to participate in the future in the program.

Those that have been in the program for some time fairly well understand the nature of the program. Some do not, but we need not go into that here. The participating laboratories have usually made it possible for postdoctoral associates to do very useful work. They recognize that this provides a means for providing interesting outside points of view to their staffs. It provides for laboratories to acquire the same kind of new blood that is given on a regular basis to universities, where new graduate students are coming through all the time.In some cases, however, they are not fully appreciative of the fact that the participating laboratory has an important obli-

gation to the postdoctoral associate. It should provide good facilities that will make the postdoctoral associate's work profitable for him as well as for the laboratory and provide an environment and an atmosphere where the professional stature of the postdoctoral associate can grow.

There is a lot to be said about the general operations within the laboratory -- the publication policies, the library facilities, and the adequacy of the machine shop, the purchasing of equipment, and so forth. The associates at at least half of the participating laboratories that I visited were well satisfied with most of these things. In fact, many times you would hear them say especially that one of the things they liked most was that they had an opportunity to get far more equipment and research facilities than they would get in a university. Also, the ability to get machine shop work done was good, and in many cases the time element involved here was not as great as they had expected. There were complaints many times about the length of time it took to purchase some equipment, and so forth. This is closely related now to one of the problems I would like to bring out with respect to the relationship between the postdoctoral associate and the laboratory to which he goes.

As you may realize, before the NRC panel rates the applicants, each applicant must make a contact with the laboratory to which he would like to go and must agree with them on his research program. Two matters come up here, and I think we can recognize some of the difficulties from the discussions we had this morning. In a sense, this is the kind of relationship whereby the NRC acts to decide on temporary employment of an individual in a laboratory. There is also the question of supervisory personnel. The laboratory doesn't always provide close enough contact to see that the field is an appropriate one in which to work and that it will get the very best effort out of its postdoctoral associate. In some cases the laboratories do this very well and try to make out advanced equipment lists and so forth. The arrangements are made perhaps for one year or two -- it is possible to renew these appointments for a second year -- but, as someone has mentioned, it is difficult to accomplish something in experimental work in a year. Taking into account that there is a time lag and that they need time to get equipment in some cases, one sees that there is often real pressure on the postdoctoral associate. If he isn't going to be renewed, he really has to find this out as early in the year as possible so that he can look for a university or industrial position.

It seems that this whole grant program would be better if the management of a laboratory would be able to tell a postdoctoral associate, where there has been a very satisfactory relationship, that he could renew the fellowship for a second year. This isn't always possible, because of uncertainty about the number of available personnel slots in the laboratories.

Many laboratories use this recruiting method, and it works out very successfully in many cases. However, there are a few problems in the selection process that I think could be smoothed out somewhat to the benefit of both parties.

I would like now to talk a little about how these people get into the program. Here I feel there is a difficulty and a problem that rests to some extent with the university where these postdoctoral associates come from. In general, there isn't a good communication between laboratories and universities in this respect. We have a member of the National Bureau of Standards

staff here, and the NBS has an especially good relationship with universities because they have a good pipeline between universities and the laboratory. That is not true in all cases. A potential research associate may find out about the program from the bulletins and brochures that are sent out for this purpose, but one finds that the research advisors in the universities are not as well acquainted with these programs as they should be. Of course, it is true that many postdoctorals want to go to a university. I think it is established that the cream of the postdoctoral crop is taken by the universities. They have the first crack at them and are in contact with them on a continuous basis. This is not being quite fair to the potential postdoctoral. The information that they receive from their research advisors in the universities should be more complete.

Let's take a look at what some of the postdoctoral associates want to get out of this program. There are some who really have not decided whether they want to go into teaching in the university or whether they would like to go into government or industry. They have not had much experience, so they would like to spend a year or two probing the situation, learning about some of the real scientific problems that concern the nation. In addition, they would like to go to places that offer them the possibility of interaction with other disciplines.

So we come back again to what an associate hopes for and what he wants to achieve in this situation. We find some criticism about the laboratories, because once they are in they don't have much contact with the other postdoctoral associates who are members of the laboratory, and they would like to have more association with their fellow associates. This is not too serious, but there are certain areas where improvements can be made.

Another thing I would like to touch upon is the determination of whether new laboratories ought to go into the program, and whether the laboratories that are in the program should continue in it. There are fairly wide differences in professional competence of the government research laboratories throughout this scale. Everybody is of good will, and they are really interested in this program. They would like to become a part of it, but in some cases they have not been able to make a self-evaluation of the laboratory and to find out what its real status is in comparison with others. These are difficult matters you have to explore when you go into laboratories of these kinds. Very often one finds that the dominant drive is to achieve some prestige, especially among new laboratories, by being accepted in the program by the National Research Council. Another benefit to the laboratory from the evaluation is that it provides them with a means of upgrading the laboratory.

The postdoctoral associates like the prestige, too, but they wish the NRC would look at the situation every once in a while. They feel lost when they go into the laboratory. I think that the NRC has been trying to do something with these visits.

In our evaluation of the laboratory, we are trying to find out solely whether one should participate in the postdoctoral research associate program. We have felt that this is not the way to build up the prestige of a laboratory, because that is a chicken and egg situation. We are trying to do justice to the postdoctoral research associate and looking out for his benefit. We want him to come out of this with an opportunity to advance his professional standing.

The kind of visits that have been made and the kind of discussions that have been had with people are tending to put this on a more realistic basis.

A majority of both the postdoctorals in this program and the laboratories recognize it as extremely worthwhile. I have mentioned some difficulties because they represent areas to focus on in improving the program.

DISCUSSION

Monday afternoon, September 11, 1967

MR. MURTAUGH: At Wisconsin is the postdoctoral considered a part of the senior faculty? Does he hold a faculty position?

DR. ALBERTY: Yes, he holds a faculty appointment, but there is no kind of departmental action required.

DR. BROGDEN: He has an academic staff appointment rather than a faculty appointment.

MR. MURTAUGH: Apparently at many institutions the postdoctoral man is not considered a member of the senior faculty. He is not a member of the department in the sense that an assistant professor or instructor is.

DR. KRAMER: I would like to ask Dr. Maurer his views on this question of foreign postdoctorals in the United States.

DR. MAURER: I think the whole question of foreign nationals in these postdoctoral positions is one of the most serious ones that should be looked at. They are members of the department, and they hold a senior faculty appointment. They are eligible to come to the faculty meetings and vote with the rest of the faculty. The truth is that if the matter is departmental business they don't show up. It takes something important like civil rights to bring them to a faculty meeting, and if anything, I would guess we would prefer to see more of them at the faculty meetings than we do.

DR. ALBERTY: Isn't it a little bad to have voting by a member of any faculty or organization where only a single professor has invited the man in?

DR. MAURER: I imagine it would be bad. I really don't think that it is necessarily so, and, in particular, I don't think there are any real problems in any of the departments that I am

acquainted with at Illinois, which really boils down to only five. Certainly the man usually comes as a result of an invitation from a specific faculty member. Everything depends upon what the attitude of the head of the department is. In the first place, the head of the department is in the position to block the appointment. The appointment needs his signature and the signature of the dean of the college, and then it needs the increasingly rubber-stamped signatures.

DR. ALBERTY: Aren't a number of those signatures often obtained a week prior to his arrival or even on his first day there?

DR. MAURER: Oh, no.

DR. ALBERTY: Are they required before the offer is made?

DR. MAURER: I think it would be the exception that a faculty member would do more than indicate that he was recommending the appointment without having discussed it with the head of the department and letting him know what he is doing.

DR. ALBERTY: I think that's fine. I think that is completely lacking at most places.

DR. MAURER: It is a very critical thing at this point as to what is the attitude of the head of the department. If the head of the department is really not a working head, if he is a man who spends half his time out of town and has his own interests, and if he delegates the operation of his department to his executive assistant, then the situation that you refer to can easily arise.

But if the head of the department is a real head of the department he knows everyone of these people as they come in. In fact, he knows the graduate students, too. He plays a critical role in integrating the postdoctoral man into the department, and if he treats the postdoctoral man differently, or rather, say, the assistant professor does not really consider that he has any interest in him, then I say that is a failure of the department head to do his job.

DR. CURTIS: In questionnaires to the agencies and program officers, I pointed out that in my experience no one except the principal investigator passed on the credentials of the postdoctoral appointee. Since positions are rarely advertised nationally, the investigator often depends on the recommendation of his limited circle of acquaintances. I asked whether one of the conditions of awarding contracts to universities should be that a

departmental committee be established to select any postdoctoral to be supported by such funds. The universal answer without exception was, "No, I don't want anybody standing between me and my faculty member in this selection of people who are going to work on this research. We are not in the education business." This is a critical point. I think that some of them should be willing to say, "Well, it is up to the department. If they set up such a committee, we would have to go along with it."

DR. MAURER: I think that any such scheme would be very satisfactory if one has experience with the way departments operate and the way the prerogatives of the faculty members are carefully observed by other faculty members. It is almost inconceivable to me that a faculty committee would turn down a man proposed for a research associateship by another member of the department. It would be a really sad case if that was presented and this happened.

I suppose that 80 percent of our postdoctorals come to us because of personal contacts. A man at Cornell who is in contact with a man at Illinois has a first class Ph.D. to suggest, and then one of our men takes him on. Under these circumstances, I do not think a faculty veto would or could arise.

DR. CURTIS: This is less true about the foreign postdoctorals. Most of them are spontaneous applications from abroad.

DR. MAURER: That's not true, because every foreign postdoctoral comes to us as a result of personal contacts with faculty members abroad. Our people from Illinois who are in Paris know everyone personally. The one exception is the Asians, and I exclude the Japanese, because all our Japanese come to us as the result of recommendations by people whom we know personally. In fact, we have probably visited their laboratories.

DR. BRAM: Was the response really the same from the NSF as from mission-oriented agencies?

DR. CURTIS: It varies among programs.

DR. BRAM: I would also be interested in hearing about any distinction between the mission-oriented agencies and those that are not, because we certainly have to be responsive to the needs of the community in interpreting our mission. We will be very glad to hear any recommendations.

MR. ARM: Did I understand that question to indicate that the granting agency should insist that this committee be set up? I think that would be extremely presumptuous.

DR. CURTIS: The suggestion was made to be far out in order to elicit response. It was phrased in this way as though it should be an agency request.

MR. ARM: I don't think we should have anything to do with telling department organizations what they should do.

DR.J.H.U. BROWN: I'd like to raise a question about the cost of postdoctoral education. Do you have any figures as to what the various institutions considered the average cost of having these individuals there.

DR.SANBORN BROWN: Yes, it varies all over the place, and we, of course, would like to wait until the subcommittee of the study reports. But I can tell you roughly that the number seems to be a thousand dollars a student.

DR. DOUKAS: This seems to be what the government agencies are paying for their postdoctorals.

DR. MAURER: Is that per year?

DR.SANBORN BROWN: Yes. It is the cost to the institution.

DR. ALBERTY: If you put faculty time in, as was mentioned earlier, it wouldn't begin to be covered by $1,000.

DR. BROWN: Let me point out that in a meeting of graduate deans a few years ago in which I was involved, the estimates ran from $15,000 per man cost to $3,000 in benefits.

DR. MAGOUN: We made a cost estimate for 210 postdoctorals at UCLA this last winter and came up with a figure that is based on faculty time which was the equivalent of 21 of the faculty for a year. The expense was about $375,000. The research expenses were estimated, and these were largely incidental operating-budget monies ranging around $500 to $1,000 per postdoctoral, which I don't think in any sense are appropriate estimates of the research expenses, totaling $120,000. The postdoctorals' stipends and salaries came to one and a half million. The aggregate figure was $2 million dollars, and divided by the 210 postdoctorals, the round number of $9,500 per postdoctoral is derived.

This expense, I would emphasize, didn't include the actual research costs nor the costs of the building or equipment or the laboratories and offices and so on. The university contributed 15 percent of the total, as best we could determine, in the form of the faculty time: this was about $300,000 to $400,000 of time. $1.7 millions or 85 percent of the total was derived from the extramural funding. So that for every dollar the university put into this thing, it got $5.50 to $6 back, or at least was supported to that extent.

DR. J.H.U.BROWN: Let me ask you a question, since you do have some data there. We have taken the position a couple of times that the Public Health Service, in particular, has been making a mistake by paying a $2,500 research allowance for predoctorals and $1,000 for postdoctorals. We have taken a position that perhaps they really should be reversed. I would be interested in your opinion.

DR. MAGOUN: I would assume that the research expense in the project grants or the program grants that support the faculty research in which the postdoctorals participate are the source of this.

DR. CURTIS: I would like to get back to the question of competition between graduate students and postdoctorals for space and faculty time. This was another part of the question which I posed to agency officers, and the replies vary according to the degree of mission-orientation of the agencies. Generally speaking, in this period of decreasing funds for research the postdoctoral is considered the most expendable by NIH and AEC. The situation is reversed in some of the other agencies where they are concerned with getting research and not with training; they feel that they can get better research from postdoctorals.

Some groups are currently looking at the question of funding and the question of balance. The people who are concerned with the question from a university point of view should get their word in. I would hate to have a decision made without the voice of the academic community of where this balance ought to be.

DR. ALBERTY: When you get into dollars, you get into a very complicated thing which many of us don't really have any experience about or basis for understanding. At MIT, they explained something to me that I hadn't understood before. Library costs and certain types of shop costs for postdoctorals at MIT are really incorporated into the overhead of the university. They are getting money under the present system even with a fellow from a government agency where there is no institutional allowance. They would be collecting something for that person because he was a body and they could count him.

If the system possibly changed, every postdoctoral who came with $2,000 would bring funds that could be used as a supplement, but this would change the way in which the money came to the institutions. It would not necessarily change the amount of money that would come to the institution, because they would then count that as income which would support the library and administrative functions.

From the standpoint of the professor or the department, it might be better if the $2,000 came to them and not in overhead calculations. On the other hand, I just want to point out that this is a very subtle thing, and I wouldn't want anybody to think that he was in a position really to make recommendations until he had talked to the business officers.

DR. BORST: The small universities can negotiate a very small overhead in order to attract contracts by absorbing some of these costs.

DR. ALBERTY: I think that the Federal postdoctoral fellowship programs ought to provide a fellowship supplement to help the fellow. I would perhaps exclude mathematics although even there, he may need it for computing. The fellow needs a lot of supplies, and this may be a very difficult problem for an institution that attracts some of these fellows. One very important fringe benefit is a fund for travel and some special equipment and supplies. Even though it is not big, it can be very valuable.

DR. DOUKAS: Dr. Kramer made a remark during his presentation that the NIH might have some figures concerning their postdoctorals. Since they may be of interest to the assembled group I thought I would mention them.

We have awarded a total of 13,265 regular postdoctoral fellowships. In the special fellowship program, which would be our more senior program comparable to the NSF Senior Postdoctoral Program, we have had a total of 3,641, giving us a grand total of almost 17,000. This does not include career awards nor the foreign postdoctoral program. During the last fiscal year, 165 foreign postdoctorals were supported under the NIH Office of International Research. The stipend and other financial arrangements for these individuals are the same as those offered under the NIH domestic fellowship programs of the Public Health Service.

Further, we do mesh our support. I believe you still offer about 28 percent of your awards in life sciences with about five percent in social sciences.

DR. KRAMER: Last night I was informed it was about 26 percent in life sciences.

DR. DOUKAS: Of our 1,088 postdoctorals last year, we had 467 in biological sciences, which is roughly 35 percent of the total. We had 395 in the medical science area, which would be 37 percent of the total. There were 103 in interdisciplinary fields, and this represents nine percent of the total. We

have only 90, or eight percent, in physical sciences, and 33, or three percent, in the social sciences. Don't let this mislead you, however, in social science areas, because this is the first year that the NIMH has been separated from us, and their figures are not included in this report.

DR. MAGOUN: I wanted to know about the very low numbers of postdoctorals in the social sciences -- between three and five percent -- supported by two agencies of which one can be identified in the Federal agency picture as having an interest in this field. I think all of us are familiar with the report of the Daddario Committee. I don't know whether the National Science Foundation is mandated by that to include the social sciences in its spectrum or not. Is it?

DR. KRAMER: It has not passed Congress.

DR. MAGOUN: I just wondered if you know of a specified mandate for it. Is the low figure in the social sciences because of the limitation on supporting postdoctoral education or are these fields uninteresting or in some way oriented differently from the natural sciences? Do we really know that the social sciences aren't interested here? Is there anyone here from the social sciences who would like to comment on the interest in this field in having more or less support for postdoctorals than presently exists?

DR. DOUKAS: Before we get into that, I would like to indicate, as I did during my statement, that I excluded the NIMH support. If we were to include this on the basis of the last five years' figures, they would range from 12 to 15 percent in social sciences. Those were the total NIH awards.

DR. MAGOUN: So, from this, one would infer that if funds were available they would be taken.

DR. McKENZIE: It was brought out that mathematics has just about the same ratio of postdoctorals to faculty that the social sciences and psychology do. In fact, engineering is not much different. I think a distinction should be made between senior and junior postdoctoral fellowships. There is more of a demand in the social sciences for the seniors, and I think they have been very useful.

DR. MAURER: What is the value of an NSF fellowship in dollars now?

DR. KRAMER: We have what we call the regular postdoctoral fellowship, and it starts with a basic stipend of $6,500 with dependency allowances of $500 for each. That is prorated over 12 months.

DR. MAURER: I think it is important here to note that the stipend is significantly below what the average research associate can get, and it is about half of what a man might hope to get if he took his Ph.D. and went into industry.

DR. KRAMER: We are now permitting them to do a little teaching and increase their income by an amount up to $2,000.

DR. MAGOUN: The median salary for postdoctorals at UCLA last year, 95% of whom were in the natural sciences, was $7,200. The research associates, as you call them, are the people who are supported with extramural funds, and for them there were no dependency allowances.

DR. DOUKAS: In a survey that we ran a little over a year ago, the postdoctoral stipends were, on the average, roughly $7,000 on the institutional level. This is one reason why we raised our fellowship stipends to $6,500. We also have the $500 dependency allowance.

DR. CURTIS: I might also say that this is borne out in our national study. The national average was of the order of $7,200.

DR. DONSKER: As you know, the demand for mathematics at the undergraduate level has increased fantastically. I doubt if any other subject has grown in recent years for undergraduate study as much as mathematics. In the last 15 years the major universities have always been looking for good young men. This winter, the bright, young Ph.D. from the best school could not get into one of the 30 schools he wanted to get into. That is a very significant change. What those young men are going to do now on the advice of their advisers is to go in for some postdoctoral work. This will increase very dramatically the demand for postdoctoral opportunities in the next year.

DR. BORST: May I extend Dr. Smith's remarks? I have been to some of the laboratories (at which NRC postdoctoral research associateship programs are in operation), and they are really quite different or isolated with a well defined mission. Frequently they have security requirements, and it is not the kind of a free type of a community that we usually find in the university. As a consequence, in my mind, the successful candidate has a much greater restriction than he would accept in a university. He must have a well defined program. He must be truly a postdoctoral, because he can expect very little or no guidance. If he is able to cope with this, then he can go on to one of the relatively isolated laboratories. If, however, he does not like this combination, then he can go to one that is more nearly like a university where there are a lot of Ph.D.'s and a lot of postdoctorals.

He then fits into the usual milieu of the scientific community. But you have a problem when you have two or three postdoctorals way off in the middle of nowhere in essentially a military laboratory.

DR. KRAMER: Have you any information on the subsequent careers of any of these research associates?

DR. SMITH: This is only by memory, but I think that in the case of the oldest laboratory in the group, the National Bureau of Standards, something like half of the postdoctoral associates who were there went into educational institutions.

DR. SILVERMAN: Somewhere between 35 and 40 percent stayed at the Bureau. Almost all of the rest have gone into universities and into teaching with the remainder divided between other government laboratories and industry. Most of the people who come to this program are not industrially oriented to begin with.

In the Bureau's experience one could say that the prime requisite for a good program of this sort is, first of all, that the very top management of the laboratory believe very strongly in the program. It has to believe in it strongly enough to assign the responsibility for it to somebody who is quite senior in the organization and who has access to the director of the laboratory when problems come up that relate to the program. Most of the people have been willing to recognize this. The second thing is that this is a very prestigious program. The reason that I really don't worry too much about the fact that the National Academy does the selection is because they have been able to attract good people.

The other thing, of course, is -- let's face it -- that money does attract brains. In looking over the group of people at the Bureau, and I now interview personally each of them as they come on board, I find that in general these people will accept an associateship of this sort at about a $2,000 difference between what we are offering them and what good industry will offer. At the present time the stipend is close to $11,000. We actually have had some people who turned down industrial jobs at $14,000. So there is an attraction to a place like the Bureau.

The Bureau is an open, very large laboratory where the things that are done are not really very different from the kind of things that are done in universities or industry. It is true that the Bureau has a mission, but the mission is

this, but the people tell me that at the moment it costs the Bureau about $23,500 a year to support a person of this sort. That would mean that, with a quota of $23,000 including my time and what not, the cost of this program is running somewhere around $650,000 a year. Out of the total appropriation budget of $30 million dollars, you see this comes down to five percent of that, which is an appreciable sum of money.

SUMMARY AND RECOMMENDATIONS

Session IV

Tuesday afternoon, September 12, 1967

SUMMARY AND RECOMMENDATIONS - GROUP 1

National Policies Concerning the Support of Postdoctoral Fellows and Associates

Robert A. Alberty, Discussion Leader

Postdoctoral research opportunities for young men are a necessity for present-day science. This further training and research experience has increasingly become a prerequisite for entering certain fields and for being appointed to certain types of positions. The young people in the best position to contribute to research need this opportunity to make a contribution to advanced research to make the maximum contribution later in their careers.

A postdoctoral appointment should provide an opportunity for advanced experience that will prepare the postdoctoral to become a leader in research and scholarship in a significant field of research. The advanced research experience may be nearly independent or as a part of a team directed by an experienced investigator, but it may also involve courses, part-time supervised teaching, and assistance in the supervision of graduate students, provided these are a part of a plan to make a significant scholarly contribution in the field of study.

The spectrum of postdoctoral appointments included in the National Research Council study is so broad that it is important to make a distinction between the different types. A large fraction of the postdoctorals have just received their Ph.D. degrees and are on 1-2 year terminal appointments. We have primarily dealt with the policies concerning these appointments. Another type of postdoctoral appointment is the sabbatical leave for an experienced professor or a temporary research appointment for a person with a Ph.D. degree having a permanent position in industry or government. Another type is represented by a person having an M.D. or D.V.M. degree who is registered as a graduate student and is a candidate for a Ph.D. degree.

Even for the first type (so-called immediate postdoctorals) a number of different types of support mechanisms and administrative arrangements are now available and are needed; these include

(1) Fellowships. The national fellowships are awarded in a competition and go to a very select group. We believe that the numbers of these fellowships awarded should be such that the group continues to be outstanding. The fellows have the advantage of selecting the institution where they will do their postdoctoral research, and we recommend that they be given certain other advantages in terms of research support, travel, and an adequate stipend (see below). We recommend research to improve the selection process for fellows. Additional fellowships are given by universities and other institutions.

(2) Research Associateships. Although a variety of terms are used, we use this term to designate postdoctorals supported on research grants or contracts. Research Associates are selected by individual professors or by groups of professors working together. In contrast to Fellows, Research Associates are obligated to work on certain projects. However, once a Fellow has picked a project, his activities and those of a Research Associate may be almost indistinguishable.

The equipment and supplies for a Research Associate are provided through a grant or contract, whereas a Fellow may have a special need for funds for this purpose.

(3) Trainees. Trainees are supported on training grants, departmental grants or other grants which provide specifically for postdoctoral training. Such a grant may be administered by a group of professors and may provide a training program, even though it may be considerably less formal than graduate work.

(4) Resident Associateships (see report of Group 3).

Each of these types of appointment has its advantage for the postdoctoral, the university, government or industrial laboratory, and the financial sponsor. A mix of programs is needed, and we hope new ones will be developed.

The following policy questions were discussed.

(1) Part-time instruction by postdoctorals. Postdoctorals should have an opportunity to participate in the instructional program of the host institution. This participation, which can take many different forms, should not prevent the accomplishment of significant research, but should be of such a nature as to contribute to the training of the postdoctoral both by the challenge of presenting the subject material and the experience in dealing with students that will prepare him for future responsibilities. The ability to communicate technical subjects is a requisite for major positions in universities, industry, or government, and so this part of a postdoctoral's experience should not be neglected. The postdoctoral should be permitted to accept additional remuneration for formal teaching responsibilities, but there should be reasonable limits to such payments and to the time spent.

(2) Postdoctoral appointments for foreign citizens. The appointment of foreign citizens in postdoctoral positions is deemed to be of great importance for getting the best research done in the United States, for contributing to the intellectual and industrial development of other countries, and for developing sound knowledge of the United States in other countries. In some cases additional funding is needed for such exchanges. Foreign postdoctorals make significant contributors to United States' research programs, but in making such appointments the future activities of the postdoctoral should be seriously considered.

(3) American postdoctoral fellows in foreign universities and laboratories. Foreign experience for United States scientists and scholars is required to keep United States science and universities strong. For some fellows, the foreign laboratory is the best place to go because techniques and ideas there are more advanced than in the United States. For other fellows, learning another point of view and another mode of operation is invaluable at that point in his career.

(4) Duration of postdoctoral appointments. In general these appointments should be limited to two years. One year is often not enough to set up apparatus or to derive the desired benefit from a foreign laboratory and so the second year should be provided if the postdoctoral's work is satisfactory. After a two-year appointment, it is to be expected the postdoctoral will take an academic or industrial appointment of the usual type.

(5) Status of the postdoctoral in the university. Many departments and university administrations have inadequate information and control over postdoctoral appointments. Many postdoctorals feel isolated and out of contact with others in the department and university. There are some bright spots around the country, but there is ample evidence that there should be more awareness and concern about both of these problems.

(6) Fellowship stipends. Stipends should be high enough so that these programs get outstanding young men and women and give them outstanding starts in their respective fields. The present situation with respect to number and quality of applicants in the various national programs appears to be healthy, but this of course needs to be watched. In view of the high quality of fellows it is desirable that their take-home pay compare favorably with that of Research Associates, but since the salaries of the latter are under the control of universities and will show considerable variation, it is not expected that fellows can be better paid than Research Associates. Fellowship stipends should also be re-examined regularly for their relation to the cost of living and professional salaries.

SUMMARY AND RECOMMENDATIONS - GROUP 2

The Selection of Postdoctoral Fellows and the Administration of Fellowship Programs

Mark Foster, Discussion Leader

(1) Purpose of postdoctoral fellowships as this purpose is implemented in the selection process.

Presently, applications are received in a variety of fields, and awards tend to be distributed to each field in proportion to number of applicants therefrom. It was felt that this may be a process which is too insensitive to isolated excellence, but only the mission-oriented agency (e.g. NIH) can provide a very rational alternative.

It was the sense of the group that the essential quality of a fellow (different from a research associate) is the confidence of his sponsor that some good science will come from his tenancy without need to pin him down initially to exactly what. "Fellowship" should therefore become known to mean this, to be awarded only to this sort of man (or woman), and should receive a discernible increment of extra compensation and prestige to mark the extra confidence implied. It was felt that senior postdoctoral fellowships are in a pretty satisfactory state now in this respect, whereas funding considerations which make reduction in number of junior postdoctorals necessary should be accepted as part of life.

"Extra compensation" was interpreted to include such possibilities as a moderately better stipend*, an allowance to the participating university (so that the word "tuition" need never be used, even if the fellow listens to classroom lectures) and perhaps an equipment/travel account to which the incumbent has access in Washington.

(2) Recognition of scientific merit in widely different fields of science.

This is a practical problem for evaluation panels. It was felt that few serious oversights occur, though distribution worries (see 1) are not completely laid to rest.

(3) Validity of the evaluation process.

It was strongly suggested that systematic research be continued (e.g. by NSF) to identify what attributes of candidates are most significant in assuring his future productivity. That such improved criteria would be employed in fellowship selection is a desirable by-product.

There was a diversity of opinion on requirement of grade transcripts for junior postdoctoral applicants. Such things do get used on some occasions. We see no need to change the present situation (no such requirement) for senior postdoctoral fellows.

(4) Fellowship tenancy at foreign universities.

We find a strong agreement that travel for travel's sake is not a proper basis for support. Some difference of opinion emerged as to how strong

*Say $7,000 basic stipend instead of $6,500.

should be the control. Positions varied from "only if it can't be done in the U.S." to "if it's a valid scientific plan, why not?"

Some attention must be given to the proprieties of foreign-exchange funding. The number of dollars involved here is not so large as to upset the nation's economy.

(5) Two-year vs. one-year fellowships.

A life-science fellowship is usually considered to be better when it is a two-year plan (even better than two one-year plans). Other types of research plans are not thus restricted, and one-year plans are more usual. The question was discussed, but no change was recommended from present practice, which is to negotiate the matter in the decision process.

SUMMARY AND RECOMMENDATIONS - GROUP 3

The Selection of Postdoctoral Research Associates and the Administration of National Research Associate Programs

Lloyd Smith, Discussion Leader

I. The Selection Process.

A. Candidates receiving graduate education in the United States.

Material now being submitted to selecting panel seems satisfactory. However, it is suggested that additional information be acquired concerning the expected or actual Ph.D. thesis title and that a reference letter be submitted by the thesis adviser or graduate-committee chairman. No change in the present practice with respect to matching the postdoctoral candidate with the participating laboratory seems needed. Also, the present practice of appointing Associates initially for one year with the possibility of renewal for an additional year should not be changed.

The National Research Council should check on gaps in the educational or employment record of the applicant.

A preference was expressed for maintaining yearly selection of candidates for programs that are now on a yearly selection basis. In other programs an effort should be made to evaluate applications in batches rather than continuously.

B. Candidates receiving graduate education in developing countries.

Use should be made of any available first-hand sources of reference information regarding the foreign university where the applicant has pursued graduate work. This might include such groups as the Committee on International Exchange of Persons; the National Association of Student Advisers; U. S. universities with foreign branches or those that have been involved in a cooperative relationship with foreign universities; and other appropriate groups.

II. Initial and Continuing Accreditation of Laboratories for Postdoctoral Research Associates.

No objection was raised with respect to the present basis of laboratory evaluation and accreditation. In borderline cases, it was recommended that the site visit be conducted by a team of several competent people. It was suggested, for laboratories which do not qualify, that some indication of the reasons should be supplied.

Other comments were made suggesting that the National Research Council be prepared to expand the Postdoctoral Research Associate Program into the areas of behavioral and social sciences as government agencies develop substantial research programs in these areas. Minor modifications in administrative procedures were also discussed.

DISCUSSION

Tuesday afternoon, September 12, 1967

DR. HARMON: Why do you say "best young people?"

DR. ALBERTY: We mean by that the best, most able young people. Those who can make a significant contribution in research -- these are the ones we want to give this opportunity to. We want them to have an opportunity to go to places that are well equipped where there is leadership and support in their area of interest and where they can make a contribution while they are young enough to do it.

DR. MAURER: I think it might be advisable to add a paragraph or a sentence to the effect that it would be highly desirable to support programs for determining the characteristics of young men which make them potential leaders and distinguished scientists. You are suggesting that more research should be done. How do you identify good men at the beginning of a career?

DR. SMITH: I am disappointed that so much emphasis is being put on the salaries of the postdoctorals. It has always been known that fellowships do not pay as well as salaries in industry. The fellowship carries with it more prestige and freedom of operation. The fellow is permitted unlimited opportunities. If I should judge a person for eligibility for a fellowship, I might penalize him a little if the salary were the important question. Other things can be a positive benefit and advantage to a national fellow. Do not disregard this fact. If you monkey with salaries you can run into trouble. They can jump 10% next year. This may interfere with the salary scale of the university. You need other than a financial incentive.

DR. FOSTER: There are other types of awards other than money -- prestige is one of them. It was the sense of our group, however, that a little extra money would not hurt. It is not necessary to put in very much extra.

DR. MAGOUN: How can we evaluate achievement in fellowship selection? Creativity? Dismal area for research.

DR. HARMON: We would try to study the selection procedures objectively. What are we doing right? What are we doing wrong? The fact that we are doing research would not assume any particular outcome.

DR. BROGDEN: Many hypotheses could be evaluated by the data OSP has been collecting. Measurements in fellowship selection provide a set of data. Behavior and performance have not been investigated yet. Research workers look on this as a field for developing models. It has great potential.

DR. DONSKER: Even professors who know a postdoctoral very well cannot judge the creativity of a man any better than the personal opinion of his thesis adviser. I judge that the best measure of a candidate's potential creativity.

DR. CURTIS: In impersonal recommendations through fellowship panels, he may be less candid than he would be in face-to-face or direct recommendation to a colleague. When you fill out a form you may tend to be less hard.

DR. DONSKER: When you recommend a fellow you are putting your reputation on the line. I think people are pretty candid.

DR. MAURER: Anyone who has had experience with NSF fellowship reference reports knows that one of the greatest difficulties is lack of candidness of references. It is difficult to decide whether a reference is giving you a true picture. According to the reference, they are all outstanding men. They are all creative. One comparison that can be made is to take an equivalent number of fellowship applications from an English university and compare them with those taken from an American university. You would find the British saying -- unintelligent, lacking in leadership, not highly original. In other words, they bear down on their candidates.

SOME PROPOSITIONS CONCERNING POSTDOCTORAL FELLOWSHIPS AND ASSOCIATESHIPS AND RESPONSES TO THEM BY MEMBERS OF THE CONFERENCE

A number of conflicting opinions were expressed at the final session of the Conference, and not every point at issue was resolved. To clarify some of these later, the organizing committee sent members of the Conference at their homes a mail ballot containing fourteen propositions which they would be free to accept, reject, or abstain from voting on, and to comment upon.

Apologies were given for an attempt to obtain opinions about complicated issues on the basis of relatively terse statements of the problems. It was believed, however, that the advantage of having taken part in two days of discussion obviated to some extent the need for extended descriptions of the problems and that, in any event, the respondents could indicate in their replies whether they felt that the capsule description made it impossible to reply.

Not all of the 29 members of the Conference returned the ballots, but the 23 who did found it possible to express an opinion about most of the propositions. They were also generous with their comments. The group of respondents was broadly representative for its size.

The propositions are stated below. Each is followed by the results of tabulating the votes and by comments -- pro and con -- concerning the proposition. Comments "pro" were made by those voting agreement with the proposition, and "con" by those in disagreement with it. Although deciding what is a consensus is a matter of opinion, considering the small-number statistics involved here, it seems clear that three of the propositions (1, 4 and 5) failed to state a consensus, and three others (2, 6 and 13) were so lightly opposed that it can be assumed that they succeeded. The other propositions fall into the gray area, and each reader is invited to make up his own mind about the extent to which there was a consensus about them. The comments are important and should be carefully weighed.

1. Various types of appointments, in and out of the universities, may provide postdoctoral experience, including fellowships, traineeships, associateships on research grants, nationally competitive associateships, and instructorships or assistant professorships which provide maximum time for research. These appointments benefit the appointing or host institution in different ways, but the benefits to the appointee are generally the same.

Agree -- 13; Disagree -- 8; Unable to judge -- 1; Not answered -- 1.

Comments:

Pro --

Assuming the opportunity exists for personal research with an identifiable personal contribution.
Assistant professors do more formal teaching.

Con --

Fellows and assistant professors are in quite different situations.
Benefits are usually widely different.
The difference between trainees and fellows is one of structured versus unstructured education.
Each appointee is an individual.
Research benefits are the same, but other benefits vary.
Individual institutional practices are more important than the type of appointment.

2. A postdoctoral appointment should leave the investigator relatively free to develop his own plan of research, or, if he is a member of a research team, to make his own identifiable contribution to the team effort. He should have ready access, however, to the advice and judgment of a senior mentor, who should consider it his responsibility to make himself available to him.

Agree -- 23; Disagree -- 0; Unable to judge -- 0; Not answered -- 0.

Comments:

Pro --

An abstract virtue. Anybody disagree?
First part of statement applies to the better qualified, second to those less experienced.
Need for flexibility is important. All are not equally mature.

3. The postdoctoral in a university should have the opportunity to participate in teaching. If he teaches, it should not be allowed to interfere with his research. He should be allowed to receive remuneration for teaching, but such remuneration should be kept within reasonable limits, keeping in mind the postdoctoral's primary obligation to research.

Agree -- 19; Disagree -- 3; Unable to judge -- 1; Not answered -- 0.

Comments:

Pro --

Under present ground rules the proposition is not tenable.
Appointees should be allowed to teach on an unpaid basis.

Con --

Postdoctoral does not always have a primary obligation to research. He may want to learn a technique, etc.

Folly to believe teaching will not interfere with research. If teaching is involved, compensation should not increase total income.
Should not be forced to teach. Some kinds of teaching would not be helpful to his research.

4. In view of the temporary nature of his appointment and the expectation that he will devote himself to research, the university postdoctoral is generally integrated satisfactorily into the academic community and is given appropriate status. No drastic changes need be made in this regard by universities at which postdoctorals do their work.

Agree -- 8; Disagree -- 10; Unable to judge -- 4; Not answered -- 1.

Comments:

Pro --

A red herring.

Con --

Integration good in some places, in others great improvement is needed.
Varies from department to department.
Many postdoctorals not included in fringe benefits open even to graduate students.
Needs care by host institution that doesn't always occur. Nominal plans all right, but not always implemented. Consciences need jogging.
The postdoctoral is often isolated, especially if unmarried. A small teaching assignment helps to integrate him.
Postdoctorals should be given some prerogatives as junior faculty.

5. It is to be expected that foreign nationals will seek postdoctoral opportunities in the United States. They should be welcomed on equal terms with United States citizens for the important contribution they make to our research effort while they are here and for the unique contribution they can make in their home countries when they return. It is unfortunate that not all the types of appointment mentioned above are equally available to them.

Agree -- 10; Disagree -- 10; Unable to judge -- 0; Not answered -- 3.

Comments:

Pro --

Carefully selected foreign students help to raise the level of our work.

Con --

Not "all!" A complicated question that cannot be handled this way.
Opposed because of brain-drain possibilities. Also opposed to a situation in which the lower stipends are being taken by foreign postdoctorals rather than U. S. graduate students.
Most foreign Ph.D.'s (except W. Europe) poorly trained.
Maintain high quality of selection -- comparable to that used for U. S. citizens going abroad for such study.
Not on equal terms.
Foreign nationals should not be eligible for all types of appointments. Less than 25%. Appointed only at first-class universities.
Foreign governments should pay for their nationals.
No teaching until it is certain they will not short-change their students.
Not in equal numbers nor in all appointments.

6. Young United States investigators should have the opportunity to hold postdoctoral appointments abroad, not only to learn from the best of foreign science, but also to represent United States science abroad, to see their subject approached from another point of view, and to become as familiar with the leading science centers in other countries as foreign scientists are with our own.

Agree -- 21; Disagree -- 1; Unable to judge -- 0; Not answered -- 1.

Comments:

Pro --

Two-way flow desirable.
Principle commendable, but dubious about availability of funds.
Ask each applicant to name an alternate U. S. institution -- if foreign-travel funds run out.
Travel should not be primary consideration. Candidates should go where the research action is.
Adequate justification should be provided.
We must be as familiar with our world neighbors as they are with us.

Con --

Best science is in the U. S.

7. A postdoctoral on a one-year appointment should normally be appointed for a second year if he desires it. One year is usually

not long enough to carry through a significant piece of research. But for a Ph.D. two years of postdoctoral work should normally be considered sufficient. A young Ph.D. who has held a postdoctoral appointment for two years should not normally have his appointment extended, nor should he be considered eligible for another award for, say, five years.

Agree -- 19; Disagree -- 4; Unable to judge -- 0; Not answered -- 0.

Comments:

Pro --

Don't like rules.
Three years might be sufficient.
Justification for second year should involve sponsor.
Exceptions may occur, but they should be few.

Con --

Don't tie his hands.
Too rigid. Consider each case on its own merits.
One year is normally enough.
A three-year period should be available to those whose research is exceedingly productive.

8. Important reasons for offering postdoctoral fellowships in national competition are to set a standard of excellence for other types of postdoctoral appointments and to recognize potential leaders in scientific research. Nationally available fellowships should carry a sufficient stipend and other benefits to attract the most able candidates seeking a postdoctoral opportunity. The base stipend, dependency allowance, travel allowance, research allowance, and other benefits of a nationally-awarded fellowship should be set at a level to make the fellowship more desirable than a university-awarded postdoctoral traineeship or associateship.

Agree -- 18; Disagree -- 4; Unable to judge -- 0; Not answered -- 1.

Comments:

Pro --

Replace "recognize . . ." in first sentence by "give best people a chance to develop."
The disparity should not be too extreme.
Grass-roots opinion supports this notion.
Prestige of fellowship adds to its desirability.

Little reason for fellowship in the absence of these conditions.
Fellowship should offer greater independence.
National competitions will result in concentrations of fellows in centers of excellence; this is O.K.

Con --

Universities often award premium stipends.
Universities prefer postdocs to be alike.
With present limited supply of fellowships, this is nonsense.

9. The average salary of research associates in universities is over $7,000. The base stipend of the postdoctoral fellowships presently offered by several Federal agencies should be raised from $6,500 to $7,000 so that, when dependency allowances and other benefits are taken into consideration, the net financial remuneration of fellows will be significantly above that of locally appointed research associates. This should be done even if it would result in a reduction in the total number of fellowships available.

Agree -- 14; Disagree -- 7; Unable to judge -- 1; Not answered -- 1.

Comments:

Pro --

O.K. if difference is $200, but not if $1,000.
$7,000 not sufficient.
Use average salaries for instructors and assistant professors as base.
We want nationally recognized men to be the best men.
Larger differential needed; salary in neighborhood of that of an assistant professor.
Moves in this direction should be deferred until we know more about stipend levels.

Con --

If person wants to work rather than go to school, he should be paid at the going rate.
A fellowship is an opportunity which should not be tied in with marketplace.
Availability of fellowships in mathematics, physics, and engineering is already inadequate.

10. In a number of departments, postdoctorals seeking appointments with individual professors are considered by the department as a group and the department selects those who seem most likely to benefit the department as a whole, its faculty members, students, and postdoctorals. Funding agencies should be encouraged to administer their support

programs in such a way as to assist departments in the pursuit of such objectives.

Agree -- 13; Disagree -- 7; Unable to judge -- 3; Not answered -- 0.

Comments:

Pro --

Departments should have reasonable control over personnel selection.
Agencies should at least not make it difficult for departments.
For the same reason, NSF and NIH award traineeship grants to institutions.
Don't make it mandatory.

Con --

So many different programs that you have to be careful.
Objective of these programs is primarily for benefit of fellows, secondarily, for departments.
Award should be to candidate, not to his supervisor.
Don't see how to implement and question whether departments often operate in this fashion.
Suggestion probably unworkable in case of DOD agencies and where individual grants and contracts are the rule.
Opposed to departmental grants as compared with individual awards.
Department, not an outside agency, should govern its practices.

11. Little or no research has been done to date on the quality of postdoctoral candidates or awardees in successive competitions, on their quality in relation to other members of their Ph.D. cohorts, or on the elements in their individual educational histories which correlate with success in the fellowship competition. Nor has research been done on the correlation between these possible predictors and the work accomplished by awardees during their period of appointment (on which they and their faculty mentors report to the sponsoring organization), or between these possible predictors and their subsequent research accomplishment. Much research is possible with the data already available, and the National Research Council should seek funds to analyze these data and report the results to those interested in postdoctoral education.

Agree -- 18; Disagree -- 1; Unable to judge -- 3; Not answered -- 1.

Comments:

Pro --

Major grant not necessary.

Present study will do some of this.
Disturbing randomness about selection of postdoctorals for research associates should be looked into.
Should also study possibilities for early identification of ability.

Con --

Costly research which would probably produce inconclusive findings.
Enthusiasm low for projects of this type.
Research not necessary.

12. Emerging fields of science, especially in interdisciplinary areas, present selection panels with special problems in the evaluation of applications for postdoctoral appointments. In general, the interdisciplinary areas are not being adequately recognized. A sub-panel of specialists in the interdisciplinary field (e.g., oceanography) should be set up whenever the number of applications in that field exceeds ten.

Agree -- 16; Disagree -- 5; Unable to judge -- 2; Not answered -- 0.

Comments:

Pro --

Use mail ballot for small numbers.
Interdisciplinary research is by non-specialists, and the panelists should be non-specialists in the interdisciplinary area.
Alternatively, see that each panel has members with recent enough training to be competent at the interfaces.

Con --

Could become a device for special favors to dubious groups.
These people already receive fair play.
No evidence exists to support second sentence.

13. The following recommendations are made with respect to the Resident Research Associateship programs administered by the National Research Council:

a. Every candidate should be asked for the title of his Ph.D. thesis;

b. One of the required references should be from the candidate's thesis adviser or from the chairman of his thesis committee;

c. The National Research Council staff should check up on any gaps in the educational or employment record of a candidate;

d. Selection of candidates should be continued on a yearly basis when it is already done annually, and every effort should be made to screen other candidates in batches rather than one by one;

e. In the case of a candidate from a developing country, the National Research Council staff should supply the panel with information about the quality of his institution (e.g., from the Committee on International Exchange of Persons, the National Association of Foreign Student Advisers, etc.);

f. A team of competent people should visit any laboratory in the program, or any laboratory wishing to participate in the program, whose ability to provide a satisfactory postdoctoral experience is in doubt;

g. Any laboratory not considered qualified to participate in the program should be informed of the reasons;

h. The National Research Council should be prepared to expand the resident associateship program into the behavioral and social sciences as soon as suitable government research programs develop in these areas.

Agree -- 21; Disagree -- 0; Unable to judge -- 2; Not answered -- 0.

Comments:

Pro --

Fellowship program also should check up on gaps in educational and employment record.
In (a), ask for abstract of Ph.D. thesis?
In (a), quality review is more important.
In (c), add: "and contact each former employer and department head."

Con --

Disagree that selection should be in batches rather than continuously.
Avoid duplication of effort if other bodies are meeting the requirement.
In (f), visit may not be best way, but some specific evaluation should occur.
Under (h), such opportunities exist already: Department of Agriculture, Bureau of the Budget. Further activity to be expected in Department of HUD.

In (b) strike out word "thesis" in "thesis committee."
Should not require a reference from thesis adviser; questionable whether NRC can check on gaps in record or supply useful information about foreign institutions.

14. National fellowship programs at present cover a wide range of disciplines, but differ in procedures for distributing awards. In the program of a mission-oriented Federal agency, the final distribution of awards is influenced by estimates of the "need" of different disciplines for fellowship support. In other programs, the awards are made only on the basis of the ability of the applicants; the need of the disciplines is not considered. The latter procedure seems preferable for a fellowship program. Special support and stimulation of new fields are better provided by "categorical" fellowship programs or by research grants than by influencing the distribution of awards in broadly-based fellowship programs.

Agree -- 18; Disagree -- 4; Unable to judge -- 1; Not answered -- 0.

Comments:

Pro --

NSF has too small a number of fellowships to make an impact by such means.
Be careful in naming programs.
Restrictions have side effects that may be undesirable: emphasis on certain disciplines may affect ability selection, sex ratio, etc.
Stick to ability as the chief criterion.

Con --

Most mission-oriented agencies already operating in as liberal a manner as possible within constraints of their mandates. Don't take a stand to handicap them or reduce availability of awards.

PROGRAM

2. Postdoctoral fellowships from the university viewpoint
   Sanborn C. Brown
3. A look at universities by a fellowship-granting agency
   Howard D. Kramer
4. Special problems of the nationally-sponsored research associate
   Lloyd Smith

Discussion

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Tuesday morning, September 12, 1967
9:00 a.m.
Group discussion

Group 1: National policies concerning the support of postdoctoral fellows and associates
Robert A. Alberty, Discussion leader

Group 2: The selection of postdoctoral fellows and the administration of fellowship programs
Mark Foster, Discussion leader

Group 3: The selection of postdoctoral research associates and the administration of national research associate programs
Lloyd Smith, Discussion leader

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Tuesday afternoon, September 12, 1967
1:00 p.m.
Session IV
Richard B. Curtis, Chairman
Summary and recommendations

Adjournment, 3:00 p.m.

National Research Council

Office of Scientific Personnel

CONFERENCE ON POSTDOCTORAL FELLOWSHIPS AND ASSOCIATESHIPS

Mt. Hope Farm Conference Center
September 10 - 12, 1967

Participants

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