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ABSTRACT

The Presidential Young Investigators (PYI) program of the National Science Foundation (NSF) has the goals of attracting and retaining outstanding young faculty members in science and engineering, improving the research capabilities of academic institutions, promoting research funding from the private sector, and fostering cooperation between academia and industry. This report assesses the program by comparing the progress of 388 members of the first two PYI groups with 204 comparable PYI nominee finalists and 197 NSF grantees of similar backgrounds. The study also surveyed individuals who had contact with PYIs. The study examines how they compared in terms of the scope and pace of their research; career progression; development of linkages to, and funding from, industry; and the balance of teaching and research in their activities. Findings indicate that the PYIs were more likely than the other groups to have gained tenure and full professorships. Greater percentages of PYIs reported changes in the direction, pace, and "riskiness" of their research than did regular Grantees, but so did a comparable percentage of Finalists. The program was successful in securing research funding from industry. Department Chairs and faculty colleagues of PYIs found that the program had a positive impact on research quality, but did not indicate a positive impact on effect on teaching, collaboration among faculty, and attracting students. (JDD)

National Science Foundation
Report 90-150
December 1990

NSF's Presidential Young Investigators Program: A Study of the First Two "Classes"

A Report by NSF's Program Evaluation Staff

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by
NSF's Program Evaluation Staff

in cooperation with

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National Science Foundation
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NSF's Presidential Young Investigators Program: A Study of the First Two "Classes"

SUMMARY

I. INTRODUCTION AND PURPOSE

This report assesses NSF's Presidential Young Investigators (PYI) program by comparing the progress of the first two PYI groups with comparable PYI nominees who qualified until the final selections, and with non-PYI NSF grantees of similar backgrounds.

The stated goals of the PYI program, begun in Fiscal Year 1984, are to: attract and retain outstanding young faculty members in science and engineering (S&E); improve the research capabilities of academic institutions; promote research funding from the private sector; and foster cooperation between academia and industry. The program was developed by the Office of Science and Technology Policy in cooperation with NSF, and the first PYI awards were made in Fiscal Year 1984.

The PYI program is unusual for NSF in that it is not based on an applicant's proposal; instead, candidates are nominated by their institutions. Nominees must be U.S. citizens or permanent residents, employed in a U.S. institution that awards doctoral degrees in at least one field supported by NSF. Nominations are reviewed by panels in each discipline with the final determination made by the NSF Director.

Each PYI awardee receives $25,000 in base funding annually for five years. PYIs are expected to seek additional funding from industrial and other non-Federal sources, which NSF then matches up to $37,500 annually. Thus, a PYI can receive up to $62,500 a year from the Foundation to a total of $100,000 annually when the non-NSF contribution is included.

Two hundred PYI awards were made in Fiscal Year 1984 and 200 in FY 1985, 43% of them in engineering fields, 26% in the mathematical and physical sciences, 13% in computer and information science and engineering, 13% in the biological, behavioral and social sciences, and 5% in the geosciences. The PYIs from those first two years were chosen for this study because they were in the final years of their awards at the time.

The study examined how they compared with non-PYIs in terms of: the scope and pace of their research; career progression; development of linkages to, and funding from, industry; and the balance of teaching and research in their activities. We also sought to learn the PYIs' own views, and the views of others, about the effectiveness of the program itself.

Seven sample groups were surveyed. Three groups were compared. the 388 PYIs remaining from the first two "classes", 204 PYI competition Finalists, and 197 NSF Grantees from the same two years who were similar in background to the other two groups.

The four other groups surveyed were: 213 department chairpersons, 284 senior faculty colleagues of PYIs, 269 graduate students, and 384 industrial representatives who had contact with PYIs.

The study was designed and directed by NSF's Program Evaluation Staff, which prepared this summary, and conducted by Westat, Inc., Rockville, Maryland. Westat's report follows the summary.

II. PRINCIPAL FINDINGS

A. Personal Characteristics

Although members of all three groups had earned their doctorates at similar institutions, the backgrounds of Grantees differed from those of PYIs and Finalists in other respects.

- 43% of those in all three comparison groups (and 48% of the PYIs) received their Doctorates from seven institutions (Univ. of Calif. at Berkeley, Stanford, California Institute of Technology, Harvard, Illinois, MIT and Princeton). (See p. 16 of this report).

- But PYIs and Finalists were somewhat more likely than Grantees to have received pre- and postdoctoral fellowships (p. 16).

- Overall, one-fifth of the members of the three groups are women and 17% are foreign-born, these proportions are higher for Grantees than for PYIs or for Finalists (p. 15).

B. Effects of the PYI Program on Attraction and Retention

The effect of the program on attracting members of the FY 1984 and FY 1985 PYI cohorts to academic research careers could not be measured because almost all of them were already well along that career path when the program was created. Also, little evidence could be shown of the program's effect on their retention in academia. The PYIs were, however, more likely than Finalists or Grantees to have gained tenure by the time of the survey, and a larger percentage were full professors.

- By the time researchers in the three comparison groups completed their graduate education, nearly all had accepted an academic or postdoctoral position (p. 24).

- Most members of the three comparison groups were still in their first academic position at the time of the survey, and almost all of them expected to continue pursuing an academic career for the next five years (p. 26)

- By late 1989, PYIs and Finalists were more likely than Grantees to be tenured, PYIs were much more likely than either of the other groups to be full professors (p. 33).

C. Effects on Research Scope, Pace and Productivity

As may be expected with the benefit of long-term, more stable funding, greater percentages of PYIs report changes in the direction, pace and "riskiness" of their research than do regular NSF Grantees -- but, surprisingly, so do a comparable percentage of Finalists (p. 35).

In measures of scientific productivity such as publications and presentations, PYIs are ahead of Grantees, but only slightly more productive than Finalists (p. 40).

D. Effects on Linkages with Industry, Including Funding

Overall, the program has been successful in securing research funding from industry. NSF financial records as of July 1, 1989 (note that some industrial matching could still be done at that point) showed that the Foundation had invested some $44.5 million by that time in the two PYI cohorts, and that the corresponding amount of industrial funds was almost $31 million. PYIs had achieved more than 84% of possible funding, though this percentage varied by field of research -- from 90% in computer fields to 76% in mathematical and physical sciences (p. 14).

When all three groups were asked to report on total grant and contract funding received since their Ph. D.s, PYIs clearly had received much more support from Federal agencies and non-government Foundations as well as from honorary awards. Surprisingly, Finalists had received about as much money from industrial sources over their careers as had PYIs, and Finalists had also received twice as much support from State agencies as PYIs (p.40).

All three groups report about the same level of correspondence, telephone calls, etc., with industrial sources. Aside from this general level of interaction, it appears that Finalists have greater linkages with industry than do PYIs, in two respects. the extent of consulting work, and the extent to which their research is conducted in industrial facilities (and vice-versa) (p. 47).

Finalist-industry relationships are also reflected in outputs to industry. Finalists report a greater level of technology and knowledge transfer and patents resulting from their work than do PYIs, and both Finalists and Grantees do more joint publishing with industry researchers than do PYIs (p.47).

Thus, in terms of industry funding alone, over their careers the Finalists (who were selected for the survey because their PYI nominations were approved all the way to the "final cut") did just about as well as the PYIs themselves. Finalists appear to be in closer working contact with industry researchers than are the PYIs. PYIs, on the other hand, are able to conduct their research with fewer industry "strings".

E. Effects on Research Capability of Academic Institutions

Department Chairs and faculty colleagues of PYIs find the quality, pace and atmosphere for research, as well as the research reputation, improving in their departments and universities as a result of the PYI program (p. 53). Lower ratings were reported by those groups for effect on teaching, collaboration among faculty, and attracting students generally.

F. Effects on Teaching and Advising

According to one of the participants in the development of the program, the effect of the PYI program on teaching was considered quite important by its founders at OSTP and NSF. However, it was never made an explicit program goal.

The survey asked the members of the comparison groups about the numbers of students and courses taught and the number of new courses and teaching materials developed over the last five years. Department chairs and faculty colleagues were asked about the effect on teaching as well. Responses show that there is essentially no difference in either the teaching load or performance of PYIs, Finalists or Grantees (p. 41).

Graduate students only infrequently provided evaluations of the program and seemed, in the main, to be unfamiliar with it.

G. Problems and Issues Raised by Respondents

The survey was designed to provide opportunities for open ended voluntary responses about any aspect of the program. In general, PYIs themselves were very positive about the program, many perceived that it allowed them to pursue "riskier" research without having to write detailed proposals, and that the PYI award provided sufficient funding to set up a laboratory. Among the remaining sample groups, Department chairs were generally most positive in their views about the program.

Many PYIs reported, though, that the process of obtaining matching funds took too much time away from research, and that sponsoring universities had left them "on their own" without much assistance in contacting non-Federal sources (p. 59). Their comments for improving the program were centered on wanting more help from NSF and from their institutions in obtaining industrial funding.

Another common theme in PYI responses was their concern about the receipt of a PYI award as an obstacle to receiving other NSF grants. Some Department chairs and Grantees also perceive this as a problem (p. 60).

The aspect of the program criticized most frequently by Department Chairs, Finalists and Grantees was the PYI selection process, particularly the use of nominations and recommendations rather than reviewed proposals (p. 60, 61).

Industry contacts did not share the reservations other sample groups expressed about the selection process, instead, they suggested actions that NSF might take to promote the program's visibility or assist or monitor corporate involvement (p. 62).

H. Additional Comments by NSF Evaluation Staff

1. To see whether having a PYI award is an obstacle to receiving other NSF grants, we compared the "success ratios" (awards divided by proposal decisions) for each member of the FY 1984 and FY 1985 PYI "classes" for several years before and after they became PYIs. The analysis showed that as a

group they were about twice as successful over the years in receiving competitively-reviewed NSF research grants as most applicants. It also showed that while there are some differences by field of research, PYIs were slightly more successful at gaining NSF grants after receiving the PYI award than before. (See Appendix B-1).

2. Almost three-fifths of FY 1984 PYIs and almost half of FY 1985 PYIs had won regular NSF research grants prior to their PYI awards. The extent of prior awards varied by field. about two-thirds of Engineering PYIs, half of those supported by the MPS and AAEO (now GEO) Directorates, and a third of those supported by the BBS Directorate had at least one prior NSF grant. (Appendix B-2).

3. The terms of the PYI program and the materials considered in the selection process have been changed since the early years to meet some of the concerns mentioned in this report. The most significant change is that current guidelines call for the nominee to submit a brief research plan for consideration by reviewers; also, the guidelines now call on nominators and referees to address the nominee's qualifications and accomplishments in teaching as well as in research.

Notes and references:

1. The current PYI program is contained in brochure NSF 90-98, Presidential Young Investigator Awards 1991 Program: Guidelines for Submission of Nominations (available from NSF Publications Unit; see inside front cover of this report).

2. In the interest of keeping this report to a reasonable size, copies of the survey instruments themselves are not attached. The basic survey (of which there were several variations) may be obtained by writing to the NSF Program Evaluation Staff, Room 425, 1800 G St. N.W., Washington, D. C. 20550.

This study was designed and managed by Jim Maher of the NSF Program Evaluation Staff (PES) and Cher Tai of the Division of Research Career Development, with the assistance of Bill Commins of PES and Jim McCullough, PES Staff Director, who wrote the summary. A team directed by Michael Wils of Westat, Inc., Rockville, Maryland, refined and mailed the survey forms, coded and analyzed the results, and prepared the body of this report. NSF funding records were compiled by Gail Williams and Vicky Twyman of NSF's Office of Information Systems. Jim Maher developed the information in Appendices B-1 through B-3.

1. INTRODUCTION

The United States depends upon technological leadership to sustain economic growth and national security. The availability of well-trained scientists and engineers to provide that leadership is essential to the Nation. Critical to providing this assurance is the need to attract outstanding young Ph.D. talent to the faculties of academic institutions and to improve the capability of these institutions to respond to the demand for highly qualified scientific and engineering personnel for academic and industrial research. In an effort to address these issues, as well as foster industry-university cooperation, the National Science Foundation (NSF) established the Presidential Young Investigator (PYI) awards program in 1984.

The PYI awards represent a partnership between private industry and the PYI investigators, their institutions, and the Federal government. The NSF awards each recipient an annual base funding of $25,000 for up to five years. The Foundation will also provide up to $37,500 in additional funds each year on a dollar-for-dollar matching-grant basis to match funds obtained from the corporate/industrial sector. In total, the matching funds allow an awardee to receive up to $100,000 annually.

At the conclusion of the first five-year cycle of the PYI Program, NSF's Program Evaluation Staff (PES), a unit within the Foundation's Office of Budget and Control, directed the evaluation of the program reported in this document. The purpose of the study is to determine and assess the impacts of the PYI program upon award recipients, their academic institutions, and participating industrial firms. The primary objective of this study is to evaluate the success of the PYI program in achieving its stated objectives of:

(1) Attracting and retaining outstanding young faculty in science and engineering;

(2) Improving the research capability of academic institutions;

(3) Promoting research funding from the private sector; and

(4) Fostering cooperation between academia and industry.

The chapters and appendices of this report provide an initial evaluation of the success the PYI program has achieved in meeting its stated objectives. Chapter 2 documents the research procedures implemented for this evaluation. Chapter 3 provides a general summary of program

costs for the 1984 and 1985 PYI cohorts as well as the extent of matching funds PYIs obtained from industry. Chapter 4 presents an overview of the careers of PYIs, Finalists, and Grantees as reflected in their career-seeking behaviors and expectations regarding their future careers. Chapters 5 and 6 discuss, respectively, the impact of the PYI program upon career progression, research, and teaching, and the extent of cooperation with industry experienced by PYIs, Finalists, and Grantees. Chapter 7 provides an overall evaluation of the PYI program as provided primarily by department chairs and faculty colleagues of PYIs.

2. EVALUATION RESEARCH PROCEDURES

This chapter provides a brief discussion of the research procedures implemented in support of the effort to evaluate the Presidential Young Investigators (PYI) program. Basically, the discussion presents a chronological recounting of the methods and steps undertaken in assembling the information about the effects of the PYI Program.

For this study, the major data collection effort consisted of the administration of mailed survey questionnaires. Seven distinct groups were surveyed:

- PYI awardees (1984 and 1985);
- Finalists (individuals nominated in 1984 or 1985 for the award, considered by the final selection panel, but not presented with an award);
- NSF Grantees never nominated for a PYI award but at a career stage comparable with the PYIs;
- Department Chairs;
- Senior Faculty Colleagues of PYIs, Finalists, and Grantees;
- Graduate Students; and
- PYI Industry Contacts.

Each group provides a particular perspective regarding the PYI program and its awardees. The main comparison groups (i.e., PYIs, Finalists, and Grantees) allow direct comparisons among groups similar in terms of career stage. Department Chair and Faculty Colleague sample groups were selected to provide an overall perspective regarding the performance of PYIs and the PYI program. Finally, Graduate Student and Industry Contact samples were compiled to determine the impact of PYIs and the PYI program upon graduate students and industry.

In the course of conducting this research, it became necessary to augment survey data collection with curriculum vitae abstraction and administrative fiscal record data collection. The procedures followed in implementing these aspects of the evaluation are also discussed in this chapter.

2.1 Sample Selection

Selection of individuals for inclusion in the PYI, Finalist, Grantee, and Department Chair groups was performed by Program Evaluation Staff (PES) analysts at NSF. Members of the Faculty Colleague, Graduate Student, and Industry Contact groups were identified through the solicitation of nominations of sample members for these groups by PYIs (Industry Contacts) and Department Chairs (Faculty Colleagues and Graduate Students).

The final sample sizes drawn for the seven groups were: (1) PYIs - 388, (2) Finalists - 206, (3) Grantees - 200, (4) Department Chairs - 225, (5) Faculty Colleagues - 284, and (6) Graduate Students - 269, and Industry Contacts - 384. PYIs and Finalists were drawn with certainty from their respective cohorts; Department Chairs were selected using a stratified design and the remaining sample groups were assembled using the nominations provided by PYIs (Industry Contacts) and Department Chairs (Faculty Colleagues and Graduate Students).

2.2 Data Collection

The evaluation's major data collection effort centered upon the administration of the mailed surveys to each of the seven sampled groups. Additionally, PES analysts compiled fiscal data from administrative records and abstracted background and career progression information from PYI, Finalist, and Grantee curriculum vitae.

Administration of the Mailed Surveys

Following completion of questionnaire design, sample selection, and the receipt of OMB clearance, questionnaires were printed for each of the seven sample groups. Based upon estimates derived from previous mailing efforts and expectations given for the response rates for each of the sample groups, sufficient numbers of questionnaires were printed to cover initial mailings and expected follow-up mailings to individuals requesting the replacement of lost or undelivered survey instruments. With the assembly of survey materials, administration of the mail survey proceeded by following a five-stage process established to maximize response rates in the mailed survey effort.

Mailing Solicitation/Prenotification Letters. After receipt of OMB clearance, solicitation and then prenotification letters were sent to sampled individuals. First, PYIs and Department Chairs were sent letters notifying them of the study, their selection for the survey mailing, and their cooperation was requested in providing names of Faculty Colleagues, Graduate Students, and Industry Contacts, as appropriate.

After this mailing and following the entering of Faculty Colleagues, Graduate Students, and Industry Contacts into the receipt control system, prenotification letters were sent to the remaining four sample groups. The purpose of this mailing was two-fold. First, it functioned as a method of improving response rates. By notifying respondents that they would soon be receiving an important survey sponsored by NSF, they would be less likely to ignore the survey when delivered. Second, the prenotification mailings provided an opportunity to correct addresses rendered bad due to poor transcription or other difficulties.

Wave 1 Survey Mailing. With the final assembly of sample lists, addresses, and updates based upon the solicitation/prenotification mailing, the first wave of surveys was mailed. All sampled individuals were mailed a survey, a cover letter explaining the purpose of the study and requesting their cooperation, and a postage-paid return envelope for return of the completed survey.

Reminder Mailing. Approximately two weeks after the first wave of survey mailings, letters sent to those individuals who had not responded asked that they send in their completed questionnaires. The reminder letter noted that if they had not received or misplaced their survey or if they had questions regarding the study, they could contact the contractor's project personnel by using a toll-free telephone number.

Wave 2 Mailing. Two weeks after the reminder mailing, the second wave of surveys was sent to individuals who had still not yet responded. The packet sent to nonrespondents contained essentially the same materials sent during the Wave 1 mailing (an introductory letter, a survey, and a return mailing envelope). This mailing increased the number of returned surveys across all sample groups.

Telephone Prompt. It was considered especially important to obtain PYI's responses into this evaluation. So, two weeks after the Wave 2 survey mailing, nonresponding PYI sample members received a telephone prompt to complete and return their surveys. In this prompt, PYIs

were asked if they had a copy of the questionnaire. If they responded that they had misplaced, lost, or never received a questionnaire, this information was noted and they were sent another copy of the questionnaire.

Response Rates. Response rates for each of the seven sample groups are presented in Table 1. Generally rates varied between 65% and 70%, indicating a good response to the survey. Industry contacts displayed the lowest response rate, 47%. This lower rate of return for the nonacademic group was not unexpected nor considered problematic.

Curriculum Vita and Administrative Fiscal Data

PES and Westat research staff determined that background information for PYIs, Finalists, and Grantees would be obtained from curriculum vitae, and fiscal information on PYI award and NSF/industry matching funds would be compiled from NSF administrative records.

A request to enclose a current curriculum vita along with their completed questionnaire was included in each survey packet sent to PYIs, Finalists, and Grantees. This method of obtaining background information was quite successful: over 75% of returned questionnaires had an associated curriculum vita.

Following survey administration, PES research staff abstracted both the returned curriculum vitae as well as the administrative financial records for PYIs, and transmitted this information to the contractor for additional processing.

2.3 Data Processing

Data processing of the three datasets (survey, CV, and fiscal information) was performed to accomplish three distinct functions:

- Survey data were processed to evaluate probable errors made during the respondent survey completion processes;
- Curriculum data were processed to facilitate merging with the survey data file; and

Table 1

Survey Response Rates by Sample Group

Sample Group	Number of Surveys Mailed	Number of Surveys Returned[1]	Number of Completed Surveys[2]	Overall Response Rate (Percent)
PYIs	388	275	268	69
Finalists	204	124	111	54
Grantees	197	142	137	70
Department Chairs	213	145	139	65
Faculty Colleagues	284	190	187	66
Graduate Students	269	190	188	70
Industry Contacts	384	188	179	47
Total	1,939	1,254	1,209	

[1]Returned category includes blank surveys mailed back to contractor.
[2]Completed category only includes completed surveys returned.

- Financial data were processed by year and division in order to produce aggregate-level reports regarding the levels and types of funding received by PYIs.

Survey Data Processing

Survey data processing was undertaken primarily to create the seven analysis files from the keypunched data and uncover and remedy probable errors made in the completion of the questionnaire by respondents. Each dataset was subjected to a series of cleaning steps to verify the accuracy of the data. Survey responses were processed through range and logic checks in order to assure that only allowable and consistent responses appeared on the analysis files.

Processing Administrative Fiscal Data

Administrative data concerning PYI award and industry matching funds for 1984 and 1985 PYI awardees were provided individually for each member of the PYI sample. Subsequent processing produced aggregate summaries of funding amounts by grant year.

Processing Abstracted Curriculum Vita Information

Background information obtained from curriculum vitae and coded by PES research staff was edited and merged onto the survey data files for PYIs, Finalists, and Grantees.

3. PYI PROGRAM COST AND INDUSTRY MATCHING FUNDS

Before consideration of the effects of the PYI program as reflected in survey responses, program funding patterns for the approximately 400 1984 and 1985 PYIs should be examined. Using NSF administrative fiscal records, data were abstracted detailing NSF PYI base and matching awards as well as matching funds PYIs received from industry. Tables 2, 3, 4, and 5 present, in order, summary funding patterns for the 1984 PYI cohort, the 1985 cohort, the combined 1984 and 1985 cohorts, and the estimated maximum funding levels possible for the combined groups. Together, these tables provide information regarding the aggregate cost of the PYI program for these cohorts and the degree to which PYIs successfully obtained matching funds to supplement the base award.

A caveat must be stated regarding these tables: the fiscal records used in compiling the information presented in Tables 2 through 5 were current as of July 1, 1989. This fact combined with NSF base and matching funds application date requirements (e.g., the 1985 cohort deadline for requesting 1988 matching funds was October 1, 1989 and the deadline for requesting base and matching funds for the 1985 cohort was/is October 1, 1989 and October 1, 1990, respectively), means that information for grant years 1988 and 1989 is incomplete. Shortfalls in funding levels may be due to unreported funding activities at the time of data compilation.

The tables break out NSF base and matching awards, industry total matching funds (i.e., funds and equipment) and equipment-only grants, and total funds by directorate and grant year for each PYI cohort. Generally, there is a very stable distribution of all categories of award across directorates and years. Ranked in terms of the relative magnitude of total awards, the Directorate for Engineering received the largest percentage of funds (~45%) followed by Mathematical and Physical Sciences (~23.5%), Computer and Information Science and Engineering (~14%), Biological, Behavioral, and Social Sciences (~13%). The Directorate for Geosciences received the smallest absolute total of awards (~4.5%).

This ranking is to be expected, given the distribution of awards by directorate: 43% of awards were to PYIs in the Engineering Directorate, 26% in the Mathematical and Physical Sciences Directorate, 13% in both the Computer and Information Science and Engineering and Biological, Behavioral, and Social Sciences Directorates, and 5% to PYIs in the Directorate for

TABLE 2 SUMMARY FISCAL RECORD FOR 1984 PYI AWARD PROGRAM COHORT

Grant Year	Directorate	PYI Base Award	NSF Matching Funds	Industry Matching Funds*	Equipment Funds	Total NSF Base+NSF Matching +Industry Matching
1984	Mathematical and Physical Sciences	$1,175,000	$1,325,412	$1,350,412	$80,500	$3,825,824
	Computer & Information Science and Engineering	$649,951	$830,034	$832,534	$58,034	$2,310,019
	Geosciences	$200,000	$159,739	$188,239	$20,000	$544,478
	Engineering	$2,024,992	$2,548,231	$2,558,231	$112,700	$7,121,454
	Biological, Behavioral and Social Science	$600,000	$653,500	$653,500	$64,441	$1,907,000
		$4,649,943	$5,516,916	$5,582,916	$335,675	$15,708,775
1985	Mathematical and Physical Sciences	$1,175,000	$1,437,994	$1,450,494	$104,500	$4,050,988
	Computer & Information Science and Engineering	$624,995	$866,800	$874,300	$76,800	$2,358,595
	Geosciences	$200,000	$189,922	$219,264	$25,000	$604,844
	Engineering	$2,025,000	$2,699,454	$2,700,454	$145,300	$7,423,908
	Biological, Behavioral and Social Science	$600,000	$712,946	$712,946	$52,475	$2,025,892
		$4,624,995	$5,907,116	$5,957,458	$404,075	$16,464,227
1986	Mathematical and Physical Sciences	$1,162,500	$1,354,810	$1,367,310	$187,360	$3,884,620
	Computer & Information Science and Engineering	$625,000	$815,000	$852,500	$28,434	$2,255,000
	Geosciences	$225,000	$200,439	$213,286	$93,000	$625,878
	Engineering	$2,624,948	$2,773,274	$2,773,274	$282,204	$7,571,496
	Biological, Behavioral and Social Science	$600,000	$810,322	$810,322	$79,441	$2,220,644
		$4,637,448	$5,953,845	$6,016,692	$670,439	$16,557,638
1987	Mathematical and Physical Sciences	$1,125,000	$1,225,060	$1,250,060	$133,791	$3,600,120
	Computer & Information Science and Engineering	$600,000	$761,500	$849,000	$65,250	$2,123,000
	Geosciences	$225,000	$210,500	$210,500	$38,243	$646,000
	Engineering	$1,975,000	$2,599,576	$2,599,576	$353,703	$7,174,152
	Biological, Behavioral and Social Science	$600,000	$815,000	$815,000	$107,400	$2,230,000
		$4,525,000	$5,611,636	$5,724,136	$698,387	$15,773,272
1988	Mathematical and Physical Sciences	$1,098,600	$1,177,171	$1,200,171	$227,654	$3,454,342
	Computer & Information Science and Engineering	$525,000	$632,500	$632,500	$43,300	$1,790,000
	Geosciences	$175,000	$205,500	$205,500	$4,000	$586,000
	Engineering	$1,850,000	$2,273,689	$2,281,140	$310,755	$6,399,878
	Biological, Behavioral and Social Science	$600,000	$686,988	$686,988	$76,238	$1,973,976
		$4,248,600	$4,975,848	$5,006,299	$661,947	$14,204,196

*Includes equipment funds

TABLE 3 SUMMARY FISCAL RECORD FOR 1985 PYI AWARD PROGRAM COHORT

Grant Year	Directorate	PYI Base Award	NSF Matching Funds	Industry Matching Funds*	Equipment Funds	Total NSF Base+NSF Matching +Industry Matching
1985	Mathematical and Physical Sciences	$1,250,000	$1,179,950	$1,179,950	$102,619	$3,634,900
	Computer & Information Science and Engineering	$650,000	$836,905	$836,905	$119,135	$2,323,810
	Geosciences	$275,000	$334,669	$334,669	$47,500	$944,338
	Engineering	$2,125,000	$2,631,404	$2,661,711	$420,649	$7,387,808
	Biological, Behavioral and Social Science	$625,000	$666,069	$666,069	$115,751	$1,957,138
		$4,925,000	$5,648,997	$5,679,304	$805,654	$16,247,995
1986	Mathematical and Physical Sciences	$1,199,900	$1,469,312	$1,469,312	$296,137	$4,138,524
	Computer & Information Science and Engineering	$650,000	$967,030	$1,014,530	$203,513	$2,584,060
	Geosciences	$275,000	$330,515	$368,015	$83,085	$936,030
	Engineering	$2,095,500	$2,796,731	$2,801,231	$782,361	$7,693,462
	Biological, Behavioral and Social Science	$625,000	$697,579	$697,579	$110,732	$2,020,158
		$4,845,400	$6,261,167	$6,350,667	$1,475,828	$17,372,234
1987	Mathematical and Physical Sciences	$1,175,000	$1,173,210	$1,190,710	$121,504	$3,538,920
	Computer & Information Science and Engineering	$650,000	$861,150	$923,650	$165,967	$2,372,300
	Geosciences	$275,000	$296,550	$296,550	$101,050	$868,100
	Engineering	$2,050,000	$2,585,236	$2,612,581	$613,900	$7,245,472
	Biological, Behavioral and Social Science	$625,000	$618,188	$618,188	$124,756	$1,861,376
		$4,775,000	$5,534,334	$5,641,679	$1,127,177	$15,886,168
1988	Mathematical and Physical Sciences	$1,150,000	$1,023,865	$1,023,865	$109,225	$3,197,730
	Computer & Information Science and Engineering	$575,000	$562,500	$625,000	$136,531	$1,700,000
	Geosciences	$275,000	$291,853	$291,853	$114,778	$858,706
	Engineering	$1,975,000	$2,378,635	$2,385,635	$358,993	$6,732,270
	Biological, Behavioral and Social Science	$550,000	$534,298	$534,298	$33,500	$1,618,596
		$4,525,000	$4,791,151	$4,860,651	$753,027	$14,107,302
1989	Mathematical and Physical Sciences	$896,435	$743,400	$743,400	$51,567	$2,383,235
	Computer & Information Science and Engineering	$350,000	$292,500	$292,500	$52,500	$935,000
	Geosciences	$100,000	$112,500	$112,500	$80,835	$325,000
	Engineering	$1,025,000	$1,180,128	$1,180,128	$90,146	$3,385,256
	Biological, Behavioral and Social Science	$425,000	$347,500	$347,500	$0	$1,120,000
		$2,796,435	$2,676,028	$2,676,028	$275,048	$8,148,491

*Includes equipment funds

TABLE 4 SUMMARY FISCAL RECORD 1984 AND 1985 PYI AWARD COHORTS

Grant Year	Directorate	PYI Base Award	Industry Matching Funds*	Total NSF Base+NSF Matching +Industry Matching
1984	Mathematical and Physical Sciences	$1,175,000	$1,350,412	$3,825,824
	Computer & Information Science and Engineering	$649,951	$832,534	$2,310,019
	Geosciences	$200,000	$188,239	$544,478
	Engineering	$2,024,992	$2,558,231	$7,121,454
	Biological, Behavioral and Social Science	$600,000	$653,500	$1,907,000
		$4,649,943	$5,582,916	$15,708,775
1985	Mathematical and Physical Sciences	$2,425,000	$2,630,444	$7,685,888
	Computer & Information Science and Engineering	$1,274,995	$1,711,205	$4,682,405
	Geosciences	$475,000	$553,933	$1,549,182
	Engineering	$4,150,000	$5,362,165	$14,811,716
	Biological, Behavioral and Social Science	$1,225,000	$1,379,015	$3,983,030
		$9,549,995	$11,636,762	$32,712,221
1986	Mathematical and Physical Sciences	$2,362,400	$2,836,622	$8,023,144
	Computer & Information Science and Engineering	$1,275,000	$1,867,030	$4,839,060
	Geosciences	$500,000	$581,301	$1,561,908
	Engineering	$4,120,448	$5,574,505	$15,264,958
	Biological, Behavioral and Social Science	$1,225,000	$1,507,901	$4,240,802
		$9,482,848	$12,367,359	$33,929,872
1987	Mathematical and Physical Sciences	$2,300,000	$2,440,770	$7,139,040
	Computer & Information Science and Engineering	$1,250,000	$1,772,650	$4,495,300
	Geosciences	$500,000	$507,050	$1,514,100
	Engineering	$4,025,000	$5,212,157	$14,419,624
	Biological, Behavioral and Social Science	$1,225,000	$1,433,188	$4,091,376
		$9,300,000	$11,365,815	$31,659,440
1988	Mathematical and Physical Sciences	$2,248,600	$2,224,036	$6,652,072
	Computer & Information Science and Engineering	$1,100,000	$1,257,500	$3,490,000
	Geosciences	$45,000	$497,353	$1,444,706
	Engineering	$385,000	$4,666,775	$13,132,148
	Biological, Behavioral and Social Science	$115,000	$1,221,286	$3,592,572
		$8,773,600	$9,866,950	$28,311,498
1989	Mathematical and Physical Sciences	$896,435	$743,400	$2,383,235
	Computer & Information Science and Engineering	$350,000	$292,500	$935,000
	Geosciences	$100,000	$112,500	$325,000
	Engineering	$1,023,000	$1,180,128	$3,385,256
	Biological, Behavioral and Social Science	$425,000	$347,500	$1,120,000
		$2,796,435	$2,676,028	$8,148,491

*Includes equipment funds

TABLE 5 PERCENTAGE OF MAXIMUM INDUSTRIAL MATCHING AND TOTAL AWARD FUNDING ACHIEVED BY COMBINED 1984 AND 1985 PYI COHORTS

Grant Year	Directorate	Maximum Possible Industry Matching Funds*	Percent of Maximum Achieved	Maximum Possible NSF + Industry Funds	Percent of Maximum Achieved
1984	Mathematical and Physical Sciences	$1,762,500	76.6	$4,700,000	81.4
	Computer & Information Science and Engineering	$975,000	85.4	$2,600,000	88.8
	Geosciences	$337,500	55.8	$900,000	60.5
	Engineering	$3,037,500	84.2	$8,100,000	87.9
	Biological, Behavioral and Social Science	$900,000	72.6	$2,400,000	79.5
		$7,012,500	79.6	$18,700,000	84.0
1985	Mathematical and Physical Sciences	$3,637,500	72.3	$9,700,000	79.2
	Computer & Information Science and Engineering	$1,950,000	87.8	$5,200,000	90.0
	Geosciences	$750,000	73.9	$2,000,000	77.5
	Engineering	$6,225,000	86.1	$16,600,000	89.2
	Biological, Behavioral and Social Science	$1,837,500	75.0	$4,900,000	81.3
		$14,400,000	80.8	$38,400,000	85.2
1986	Mathematical and Physical Sciences	$3,600,000	78.8	$9,600,000	83.6
	Computer & Information Science and Engineering	$1,912,500	97.6	$5,100,000	94.9
	Geosciences	$750,000	77.5	$2,000,000	78.1
	Engineering	$6,225,000	89.6	$16,600,000	92.0
	Biological, Behavioral and Social Science	$1,837,500	82.1	$4,900,000	86.5
		$14,325,000	86.3	$38,200,000	88.8
1987	Mathematical and Physical Sciences	$3,525,000	69.2	$9,400,000	75.9
	Computer & Information Science and Engineering	$1,875,000	94.5	$5,000,000	89.9
	Geosciences	$750,000	67.6	$2,000,000	75.7
	Engineering	$6,112,500	85.3	$16,300,000	88.5
	Biological, Behavioral and Social Science	$1,837,500	78.0	$4,900,000	83.5
		$14,100,000	80.6	$37,600,000	84.2
1988	Mathematical and Physical Sciences	$3,375,000	65.9	$9,000,000	73.9
	Computer & Information Science and Engineering	$1,650,000	76.2	$4,400,000	79.3
	Geosciences	$712,500	69.8	$1,900,000	76.0
	Engineering	$5,812,500	80.3	$15,500,000	84.7
	Biological, Behavioral and Social Science	$1,762,500	69.3	$4,700,000	76.4
		$13,312,500	74.1	$35,500,000	79.8
1989	Mathematical and Physical Sciences	$1,350,000	55.1	$3,600,000	66.2
	Computer & Information Science and Engineering	$525,000	55.7	$1,400,000	66.8
	Geosciences	$150,000	75.0	$400,000	81.3
	Engineering	$1,575,000	74.9	$4,200,000	80.6
	Biological, Behavioral and Social Science	$637,500	54.5	$1,700,000	65.9
		$4,237,500	63.2	$11,300,000	72.1
Total	Mathematical and Physical Sciences	$17,250,000	70.9	$46,000,000	77.6
	Computer & Information Science and Engineering	$8,887,500	87.0	$23,700,000	87.6
	Geosciences	$3,450,000	70.7	$9,200,000	75.4
	Engineering	$28,987,500	84.7	$77,300,000	88.1
	Biological, Behavioral and Social Science	$8,812,500	74.2	$23,500,000	80.6
		$67,387,500	79.4	$179,700,000	83.7

*Assumes maximum match of $37,500 for each PYI

Geosciences. Since the number of awards by directorate remained relatively constant over the period being studied, it is reasonable that the relative magnitudes of award amounts would also remain fairly constant.

The total base cost of the PYI program also remained stable throughout the period of award, remaining somewhat under $5,000,000 per year per cohort. Aggregating across all years the total base cost of the PYI program (base and matching funds) for the 1984 and 1985 cohorts was $44,552,821 and the total amount of industry matching funds obtained was $30,963,529.

These tables exhibit a characteristic that may provide some insight into funding patterns generally, for PYIs. There are differences in the average total award by directorate. For example, considering 1985 awards, we see that the average total award in the Mathematical and Physical Science Directorate was approximately $79,000 while in the Engineering Directorate the corresponding figure was nearly $89,000. Clearly, there are differences by directorate in the degree to which matching industry funds are obtained. These patterns are underscored by comments made by a geologist interviewed during the preliminary stages of this project. When asked about seeking industry matching funds, he replied "I really don't need any additional funds and probably won't seek them. My work consists of mathematical modeling so, except for access to a computer, I am very well taken care of by the base PYI grant." Discipline and substantive area, then, can contribute to differential levels in industry matching funds and, therefore, the average total award by directorate.

When viewing aggregate funding levels (industry matching and total - Table 5) in the context of maximum possible funding, it is seen that PYIs achieve approximately 84% of total possible funding. This translates into an average base funding of $25,000 (from NSF) and $30,000 each from industry and NSF in matching funds (these average figures include the expected shortfalls for 1988 and 1989). However, actual percentage of maximum funding does vary by directorate. In 1987, for example, the directorates achieving the highest and lowest percentages of maximum possible funding were Computer and Information Science and Engineering (90%) and Mathematical and Physical Sciences (76%), respectively. Overall, however, the PYI program appears to have proved successful in securing a funding linkage with industry. As a percentage of total funding, industry funds contribute significantly to research funds available to PYIs.

4. PYIs, FINALISTS, AND GRANTEES - BACKGROUND INFORMATION AND PROFESSIONAL CAREERS

The background characteristics of PYIs, Finalists, and Grantees and their careers and career-seeking behaviors share many similarities. This is not surprising since each member of these groups has been judged to be a promising young scientist, either through the PYI selection process or NSF's regular project grant application process.

This chapter presents summary information regarding the background and careers of PYIs, Finalists and Grantees in each comparison sample, notes their expectations regarding future career possibilities, and explores their shared attitudes in evaluating factors relevant to career decisions and the success of scientific research.

4.1 Background Information

Table 6 illustrates the gender distribution of PYIs, Finalists, and NSF Grantees. Overall, the distribution among these groups is approximately an 80/20 division. There are differences among the groups, however. More PYIs are female than are Finalists. The group including the highest proportion of females, though, is Grantees.

Table 6

Gender Distribution of PYIs, Finalists, and Grantees

	PYIs		Finalists		Grantees	
	Percent	Count	Percent	Count	Percent	Count
Male	80.6	195	86.3	82	72.2	83
Female	19.4	47	13.7	13	27.8	32

Table 7 provides more detailed information regarding PYIs, Finalists, and Grantees. In this table foreign-born sample members are arrayed by their birth country. As this table shows, 78 sample members were born in one of 26 foreign countries. Of these countries, two (India and the United Kingdom) accounted for nearly one-third of all foreign-born sample members. Slightly over one-half of all foreign born PYIs, Finalists, and Grantees were from six countries (India, England, Taiwan, Belgium, Canada, and Greece).

Among the sample groups, some differences exist in the proportions of foreign born. PYIs and Finalists have the smallest percentages of foreign born members (17% and 15%, respectively), while 25% of the Grantees were foreign-born.

Table 8 presents the doctoral institutions that PYIs, Finalists and Grantees attended. Sample members report a total 106 graduate institutions. In the three sample groups, 45% received doctoral degrees from one of seven graduate institutions (University of California at Berkeley, Stanford University, California Institute of Technology, Harvard University, Illinois University, MIT, and Princeton University). (Appendix A provides an accounting of undergraduate institutions.)

Clearly, members cluster in a few selected institutions for their graduate training. However, PYIs do not appear to be concentrated in the more popular institutions than are Finalists and Grantees overall (though differences exist by institution). In the aggregate, 48% of PYIs received their doctorate from one of the top 7 institutions, as compared to the total sample average of 45%.

In the area of fellowships, we do begin to discern some consistent and interpretable differences among the sample groups. Tables 9 and 10 present the distribution of predoctoral and postdoctoral fellowships by PYI, Finalist, and Grantee sample groups. In both tables there is the same ranking of sample groups. For predoctoral fellowships (dominated by the Sloan Fellowship), 47 funding sources yielded a total of 109 fellowships. Distributed among the sample groups, 26% of PYIs, 24% of Finalists, and 18% of Grantees received funding.

The distinction among the sample groups is even clearer for postdoctoral fellowships: fewer sources (i.e., 24) yielded 66 fellowships. When the distribution among sample groups is computed, 17% of PYIs, 15% of Finalists, and 10% of Grantees received fellowships. Although PYIs and Finalists are young researchers without an established research track record, they seem to have, as sample groups, more established records than Grantees in obtaining fellowships.

Table 7

Distribution of Foreign-Born PYIs, Finalists, and Grantees by Birth Country[1]

	PYIs		FINALISTS		GRANTEES		TOTAL
BIRTH COUNTRY	Percent	Count	Percent	Count	Percent	Count	Count
ARGENTINA	4.65	2	.	.	3.45	1	3
AUSTRALIA	4.65	2	.	.	3.45	1	3
AUSTRIA	2.33	1	10.00	1	3.45	1	3
BELGIUM	9.30	4	.	.	.	.	4
CANADA	6.98	3	.	.	3.45	1	4
CHINA	2.33	1	10.00	1	3.45	1	3
COLOMBIA	.	.	10.00	1	3.45	1	2
CYPRUS	2.33	1	.	.	.	.	1
CZECHOSLOVAKIA	.	.	.	.	3.45	1	1
EGYPT	4.65	2	.	.	3.45	1	3
ENGLAND	11.63	5	20.00	2	20.69	6	13
FRANCE	2.33	1	.	.	.	.	1
E. GERMANY	2.33	1	.	.	3.45	1	2
GREECE	6.98	3	10.00	1	.	.	4
INDIA	11.63	5	20.00	2	20.69	6	13
INDONESIA	.	.	10.00	1	.	.	1
ISRAEL	9.30	2	.	.	3.45	1	3
JAPAN	.	.	.	.	3.45	1	1
MEXICO	2.33	1	.	.	.	.	1
POLAND	.	.	.	.	3.45	1	1
RUMANIA	.	.	.	.	3.45	1	1
SCOTLAND	2.33	1	.	.	.	.	1
SOUTH AFRICA	2.33	1	10.00	1	.	.	2
TAIWAN	4.65	2	.	.	10.34	3	5
TURKEY	2.33	1	.	.		.	1
WEST GERMANY	2.33	1	.	.	.	.	1
TOTAL	50.11	40	12.20	10	35.37	28	78

[1]Information obtained from PYI, Finalist, and Grantee CVs. Zeros replaced with ".".

Table 8

Doctorate Degree Institutions for PYIs, Finalists, and Grantees[1]

	PYIs		FINALISTS		GRANTEES		TOTAL
INSTITUTION	Percent	Count	Percent	Count	Percent	Count	Count
ADELAIDE, UNIV OF	0.41	1	.	.	.	.	1
ALBERTA, UNIV OF	0.41	1	.	.	.	.	1
ARIZONA STATE UN	.	.	1.05	1	.	.	1
ARIZONA UNIV	1.65	4	.	.	1.75	2	6
AUSTRALIAN NAT UNIV	0.41	1	.	.	.	.	1
BIRMINGHAM UNIV	.	.	.	.	0.88	1	1
BROWN UNIV	1.24	3	3.16	3	0.88	1	7
BRYNN MAWR COLL	.	.	1.05	1	.	.	1
CALIF INST TECH	6.61	16	6.32	6	6.14	7	29
CALIF, UNIV BERKELEY	6.61	16	15.79	15	9.65	11	42
CALIF, UNIV DAVIS	.	.	.	.	0.88	1	1
CALIF, UNIV IRVINE	0.41	1	.	.	0.88	1	2
CALIF, UNIV LA	2.07	5	.	.	0.88	1	6
CALIF, UNIV SAN DIEGO	0.83	2	.	.	0.88	1	3
CALIF, UNIV SF	0.83	2	.	.	.	.	2
CALIF, UNIV SB	0.41	1	2.11	2	.	.	3
CALIF, UNIV SANTA CRUZ	.	.	.	.	0.88	1	1
CAMBRIDGE, UNIV	1.65	4	.	.	0.88	1	5
CARNEGIE MELLON	1.65	4	1.05	1	0.88	1	6
CATH UNIV OF	0.41	1	.	.	.	.	1
CHICAGO, UNIV OF	1.65	4	2.11	2	0.88	1	7
CHRIST CHURCH UNIV	.	.	.	.	0.88	1	1
CLARK UNIV	.	.	1.05	1	.	.	1
CLARKSON COLL OF	0.41	1	.	.	.	.	1
CLEMSON	.	.	.	.	0.88	1	1
COLORADO STATE UNIV	0.83	2	.	.	1.75	2	4
COLORADO UNIV	0.83	2	.	.	0.88	1	3
COLUMBIA UNIV	1.24	3	1.05	1	0.88	1	5
CONNECTICUT. UNIV	0.41	1	.	.	0.88	1	2
CORNELL UNIV	1.65	4	3.16	3	4.39	5	12
DALHOUSIE UNIV	.	.	.	.	0.88	1	1
DELAWARE UNIV	.	.	1.05	1	0.88	1	2
DUKE UNIV	0.83	2	.	.	.	.	2
EAST ANGLIA UNIV	.	.	.	.	0.88	1	1
EIDGENOSSISCHE	0.41	1	.	.	.	.	1

[1]Information obtained from PYI, Finalist, and Grantee CVs. Zeros replaced with ".".

Table 8 (Continued)

INSTITUTION	PYIs		FINALISTS		GRANTEES		TOTAL
	Percent	Count	Percent	Count	Percent	Count	Count
ETH ZURICH, SWIT	.	.	.	.	0.88	1	1
FLORIDA STATE UNIV	.	.	1.05	1	.	.	1
FLORIDA UNIV	0.41	1	.	.	0.88	1	2
GLASGOW, UNIV	0.41	1	.	.	.	.	1
HARVARD UNIV	7.44	18	3.16	3	1.75	2	23
HOUSTON, UNIV OF	.	.	1.05	1	0.88	1	2
ILLINOIS UNIV	3.29	8	5.26	5	6.14	7	20
IMPERIAL COLLEGE	0.41	1	.	.	.	.	1
INDIANA UNIV	.	.	.	.	0.88	1	1
INNSBRUCK UNIV	.	.	1.05	1	.	.	1
IOWA STATE UNIV	0.41	1	1.05	1	0.88	1	3
IOWA, UNIV OF	0.41	1	1.05	1	.	.	2
JOHNS HOPKINS UNIV	0.83	2	2.11	2	0.88	1	5
KANSAS, UNIV OF	0.41	1	.	.	.	.	1
KENTUCKY, UNIV OF	0.83	2	.	.	.	.	2
LEEDS UNIV	0.41	1	.	.	.	.	1
LONDON, UNIV	.	.	.	.	0.88	1	1
MANCHESTER UNIV	.	.	.	.	0.88	1	1
MANITOBA UNIV CA	0.41	1	.	.	.	.	1
MARYLAND, UNIV	0.83	2	.	.	0.88	1	3
MASS INST TECH	8.68	21	8.42	8	6.14	7	36
MASS, UNIV OF	0.41	1	.	.	0.88	.	2
MICHIGAN STATE UNIV	0.41	1	.	.	0.88	1	2
MICHIGAN TECH UNIV	.	.	1.05	1	0.88	1	2
MICHIGAN UNIV	1.24	3	1.05	1	2.63	3	7
MINNESOTA UNIV	2.48	6	4.21	4	1.75	2	12
NEW MEXICO UNIV	0.41	1	.	.	0.88	1	2
NORTH CAROLINA STATE	.	.	1.05	1	.	.	1
NORTH CAROLINA UNIV	0.41	1	.	.	.	.	1
NORTHWESTERN UNIV	0.83	2	1.05	1	0.88	1	4
OHIO STATE UNIV	1.24	3	2.11	2	.	.	5
OREGON GRADUATE	0.41	1	.	.	.	.	1
OREGON STATE UNIV	.	.	.	.	0.88	1	1
OREGON, UNIV OF	0.41	1	.	.	.	.	1
OXFORD UNIV UK	.	.	1.05	1	0.88	1	2
PENN STATE UNIV	0.41	1	1.05	1	0.88	1	3
PENN, UNIV OF	1.65	4	.	.	0.88	1	5

Table 8 (Continued)

INSTITUTION	PYIs		FINALISTS		GRANTEES		TOTAL
	Percent	Count	Percent	Count	Percent	Count	Count
PITTSBURGH UNIV	.	.	1.05	1	.	.	1
PRINCETON UNIV	6.20	15	3.16	3	1.75	2	20
PURDUE UNIV	2.48	6	4.21	4	.	.	10
READING, UNIV UK	.	.	.	.	0.38	1	1
RENSSELEAR POLYTECH	.	.	.	.	0.88	1	1
RICE UNIV	0.41	1	1.05	1	.	.	2
ROCHESTER UNIV OF	.	.	.	.	0.88	1	1
SHEFFIELD UNIV	0.41	1	.	.	.	.	1
SOUTH CAROLINA	0.41	1	.	.	.	.	1
SOUTH FLORIDA UNIV	.	.	.	.	0.88	1	1
SOUTHERN CALIF UNIV	.	.	.	.	3.51	4	4
STANFORD UNIV	9.50	23	5.26	5	6.14	7	35
STUTTGART, UNIV	0.41	1	.	.	.	.	1
SUNY AT ALBANY	0.41	1	.	.	.	.	1
SUNY AT BUFFALO	0.41	1	.	.	.	.	1
SUNY AT STONY BROOK	0.41	1	.	.		.	1
TECHNION, HAIFA	.	.	.	.	0.88	1	1
TECHNISCHE UNIV	.	.	1.05	1	0.88	1	2
TELAVIV UNIV	0.41	1	.	.	.	.	1
TEXAS A&M UNIV	.	.	.	.	1.75	2	2
TEXAS TECH UNIV	.	.	.	.	0.88	1	1
TEXAS UNIV	0.82	2	1.05	1	.	.	3
TEXAS UNIV, DALL	0.41	1	.	.	.	.	1
TORONTO, UNIV OF	2.48	6	1.05	1	0.88	1	8
UTAH STATE UNIV	.	.	1.05	1	.	.	1
UTAH UNIV OF	0.41	1	.	.	0.88	1	2
VIRGINA POLYTECH	.	.	1.05	1	.	.	1
WASHINGTON UNIV ST	0.83	2	.	.	0.88	1	3
WASHINGTON, UNIV	1.24	3	.	.	.	.	3
WATERLOO, UNIV OF	.	.	.	.	0.88	1	1
WAYNE STATE UNIV	.	.	1.05	1	.	.	1
WEST VIRGINIA UNIV	.	.	1.05	1	0.88	1	2
WISCONSIN UNIV	2.07	5	4.21	4	3.51	4	13
YALE UNIV	1.24	3	.	.	0.88	1	4
TOTAL	53.41	243	21.32	97	25.27	115	456

Table 9

Distribution of Predoctoral Fellowships Among PYIs, Finalists, and Grantees by Funding Source[1]

	PYIs		FINALISTS		GRANTEES		TOTAL
FUNDING SOURCE	Percent	Count	Percent	Count	Percent	Count	Count
AAAS ENVIRON	1.56	1	.	.	.	.	1
ALLOY SURFACES	.	.	.	.	5.00	1	1
AMER-SCANDINAVIAN	1.56	1	.	.	.	.	1
BELL LABORATORY	1.56	1	.	.	.	.	1
BETTERYMAR	.	.	4.35	1	.	.	1
BROWN UNIV	.	.	4.35	1	.	.	1
CABELL	.	.	4.35	1	.	.	1
CAL TECH	.	.	4.35	1	5.00	1	2
CAL, UNIV JR FAC	.	.	4.35	1	.	.	1
CHEVRON OIL	1.56	1	.	.	.	.	1
CORINNA BORDEN	.	.	.	.	5.00	1	1
DANFORTH	1.56	1	.	.	.	.	1
EARL C ANTHONY	1.56	1	.	.	.	.	1
EXXON	.	.	.	.	5.00	1	1
FACULTY DEVELOPMENT	1.56	1	.	.	.	.	1
FOGARTY	.	.	4.35	1	.	.	1
GELB FOUNDATION	.	.	4.35	1	.	.	1
GENERAL MOTORS	3.13	2	.	.	.	.	2
GEORGE VAN NESS	1.56	1	.	.	.	.	1
GREEN	1.56	1	.	.	.	.	1
GUGGENHEIM	9.38	6	.	.	.	.	6
GULF	.	.	8.70	2	.	.	2
HARVARD UNIV	.	.	4.35	1	.	.	1
INTER NICKEL CO	1.56	1	.	.	.	.	1
INTER PAPER CO	1.56	1	.	.	.	.	1
INTER HARVESTER	.	.	.	.	5.00	1	1
KELLOG	1.56	1	.	.	.	.	1

[1]Information obtained from PYI, Finalist, and Grantee CVs. Zeros replaced with ".".

Table 9 (Continued)

FUNDING SOURCE	PYIs		FINALISTS		GRANTEES		TOTAL
	Percent	Count	Percent	Count	Percent	Count	Count
KNOX	.	.	4.35	1	.	.	1
LILLY	.	.	4.35	1	.	.	1
LINDEMANN	1.56	1	.	.	.	.	1
MARSHAL	.	.	.	.	5.00	1	1
MEDICAL RES COUNCIL	1.56	1	.	.	5.00	1	2
MELLON	1.56	1	.	.	.	.	1
MIT	1.56	1	.	.	.	.	1
NASA	1.56	1	.	.	5.00	1	2
NETHERLANDS	1.56	1	.	.	.	.	1
NSF	.	.	.	.	10.00	2	2
PACER	1.56	1	.	.	.	.	1
REGENTS	.	.	4.35	1	.	.	1
ROHM AND HAAS	.	.	.	.	5.00	1	1
SEARLE	4.69	3	4.35	1	.	.	4
SHELL	.	.	4.35	1	.	.	1
SLOAN	50.00	32	30.43	7	50.00	10	49
TORONTO OPEN FE	1.56	1	.	.	.	.	1
UNIV OF CALIF	.	.	.	.	5.00	1	1
UNIVOFIL	.	.	4.35	1	.	.	1
WHITNEY	1.56	1	.	.	.	.	1
TOTAL	59.72	64	21.10	23	20.18	22	109

Table 10

Distribution of Postdoctoral Fellowships Among PYIs, Finalists, and Grantees by Funding Source[1]

	PYIs		FINALISTS		GRANTEES		TOTAL
FUNDING SOURCE	Percent	Count	Percent	Count	Percent	Count	Count
BANTRELL	.	.	.	.	9.09	1	1
DAMON RUNYON	7.14	3	.	.	.	.	3
DFG	2.38	1	.	.	.	.	1
FERMI	2.38	1	.	.	.	.	1
FULBRIGHT	.	.	10.00	1	.	.	1
GAS RESEARCH INST	2.38	1	.	.	.	.	1
HARVARD	2.38	1	.	.	.	.	1
HERTZ	.	.	.	.	9.09	1	1
HUMBOLDT	7.14	3	20.00	2	9.09	1	6
IBM	.	.	.	.	9.09	1	1
LATHROP	2.38	1	.	.	.	.	1
MARCONI	.	.	10.00	1	.	.	1
MEDICAL FOUND	2.38	1	.	.	.	.	1
MILLER	7.14	3	.	.	.	.	3
NATO	14.29	6	20.00	2	18.18	2	10
NDM	2.38	1	.	.	.	.	1
NFWO	2.38	1	.	.	.	.	1
NIH[2]	16.67	7	20.00	2	.	.	9
NRC	.	.	.	.	9.09	1	1
NSF[2]	28.57	12	20.00	2	27.27	3	17
OPPENHEIMER	.	.	10.00	1	.	.	1
VON BRAUN	2.38	1	.	.	.	.	1
WHITNEY	2.38	1	.	.	.	.	1
XEROX	.	.	.	.	9.09	1	1
TOTAL	65.63	42	17.19	11	17.19	11	64

[1]Information obtained from PYI, Finalist, and Grantee CVs. Zeros replaced with ".".

[2]Includes two fellowships shared between NIH and NSF.

4.2 PYI, Finalist, and Grantee Areas of Science, Career-Seeking Behaviors, and Expected Future Career

Table 11 displays the distribution of PYIs, Finalists, and Grantees by major area of science and/or engineering. The distribution of PYIs, as expected, closely approximates the distribution of awards across disciplines in 1984 and 1985, when 43% of awards were given in the area of engineering and 25% were awarded in the area of the mathematical and physical sciences.

Comparing the distribution of PYIs to that for Grantees, we see that there is no statistically significant difference between these two distributions. This correspondence is expected, as the sampling plan for Grantees was designed to assure a disciplinary distribution similar to that of PYIs in 1984 and 1985.

Finalists, however, do display a distribution quite different than those observed for PYIs or Grantees. Engineering is significantly overrepresented for Finalists and the mathematical and physical sciences are underrepresented. This composition of the Finalist group is a result of the PYI selection process: individuals in this group were all considered by the final PYI selection board but did not receive an award. Compared to awardees, a disproportionate number of nominees from engineering were among those not receiving PYI awards.

Despite these differences in distribution by discipline, the career-seeking behaviors displayed by all groups after completing their graduate education are nearly identical. Table 12 shows the percentage of PYIs, Finalists, and Grantees considering, pursuing, and accepting various types of employment. More than any other career, members of these groups sought academic employment. Indeed, there are no statistically significant differences among group distributions.

The responses in each employment category are not mutually exclusive so we see that individuals considered opportunities offered by several career options. By the time an employment offer was received and acted upon, however, only a very small percentage of individuals accepted nonacademic positions. Clearly, by the time individuals in these groups were completing their graduate education they were, for the most part, firmly decided upon an academic career track.

Table 11

First Reported Major Area of Science and/or Engineering

	PYIs		Finalists		Grantees	
	Percent	Count	Percent	Count	Percent	Count
Engineering	44.5	118	60.0	66	48.1	64
Mathematics	13.2	35	4.5	5	15.1	20
Physics	11.0	29	5.5	6	8.2	11
Chemistry	7.9	21	8.2	9	9.1	12
Physical Sciences	3.4	9	0.9	1	2.2	3
Earth Sciences	4.5	12	9.1	10	6.8	9
Life Sciences	14.0	37	10.0	11	8.2	11
Psychology	1.1	3	0.0	0	0.6	1
Social Sciences	0.4	7	1.8	2	1.5	2

Table 12

Career-Seeking Activities Undertaken While Completing Ph.D.

	PYIs		Finalists		Grantees	
	Percent	Count	Percent	Count	Percent	Count
Actively Considered						
Academic Position	81.3	218	80.2	89	86.1	118
Postdoctoral Position	51.9	139	46.8	52	47.4	65
Industrial Employment	49.3	132	51.4	57	49.6	68
Government Employment	16.4	44	18.0	20	16.8	23
Applied for Position						
Academic Position	74.3	199	74.8	83	79.6	109
Postdoctoral Position	47.8	128	41.4	46	46.0	63
Industrial Employment	37.3	100	38.7	43	39.4	54
Government Employment	9.0	24	11.7	13	8.0	11
Employment Offer Received						
Academic Position	67.9	182	70.3	78	74.5	102
Postdoctoral Position	46.6	125	40.5	45	44.5	61
Industrial Employment	33.3	90	36.0	40	29.9	41
Government Employment	6.0	16	7.2	8	5.1	7
Accepted Employment Offer						
Academic Position	59.0	158	60.4	67	59.9	82
Postdoctoral Position	38.8	104	32.4	36	37.2	51
Industrial Employment	5.2	14	6.3	7	6.6	9
Government Employment	1.9	5	1.8	2	0.0	0

The idea of strong career tracking is reinforced if the reported probable careers of group members five years hence are examined. Respondents were asked on a five-point scale to rate the probability that they would be pursuing each of four careers five years in the future. Table 13 reports the percentage of individuals stating that it was "very likely" or "likely" that they would be pursuing the referenced career. Obviously, the responses reported here were also not mutually exclusive, but it is striking that well over 90% of members in each of the three groups stated that their probable future career would remain in academia.

Table 13

Probable Career in Next Five Years

	PYIs		Finalists		Grantees	
	Percent	Count	Percent	Count	Percent	Count
Academic Career	97.8	262	98.2	109	94.9	130
Private Career	13.4	35	11.7	13	12.6	17
Public Career	3.8	10	5.6	6	6.8	9
Self-Employed	10.0	26	9.1	10	9.7	13

Larger than expected percentages of individuals reported it probable that they might pursue either a private or self-employed career. A review of notes taken during preliminary interviews with PYI and Finalists provided a possible explanation for this finding. Several of the individuals interviewed spoke of their work in industry as if it were a separate career. They viewed such work as obtained through their efforts and, therefore, separate from their academic appointment. The fact that well over 90% of respondents in each group said that they would probably be in academia five years hence and over 20% reported it probable that they would be self-employed or have a private career is considered a reflection of the belief by some scientists and engineers they can indeed have two careers - one public and one private.

The notion that members of all three comparison sample groups have long been on an academic career track is further reinforced by Tables 14 and 15. In these tables information regarding current and prior employment history (as reported on curriculum vitae) is presented. As these tables show, nearly three-quarters or more of all respondents report no industry

Table 14

Industrial Employment - Number of Positions Reported on Curriculum Vita

	PYIs		Finalists		Grantees	
	Percent	Count	Percent	Count	Percent	Count
Number of Positions						
0 Positions	81.8	198	73.7	70	76.5	88
1 Position	12.8	31	15.8	15	18.3	21
2 Positions	4.1	10	8.4	8	2.6	3
3 Positions	1.2	3	2.1	2	0.0	0
4 Positions	0.0	0	0.0	0	2.6	3

Table 15

Academic Employment - Number of Positions Reported on Curriculum Vita

	PYIs		Finalists		Grantees	
	Percent	Count	Percent	Count	Percent	Count
Number of Positions						
0 Positions	0.0	0	1.1	1	0.9	1
1 Position	64.5	156	73.7	70	63.5	73
2 Positions	32.6	79	20.0	19	27.0	31
3 Positions	2.9	7	4.2	4	6.1	7
4 Positions	0.0	0	0.0	0	0.9	1
5 Positions	0.0	0	1.1	1	1.7	2

employment. Conversely, 90% or more report one or at most two academic positions. Not only are sample members firmly committed to an academic career, they display little inclination to move from position to position, as reflected in the rather limited mobility reported.

Regarding the influence of the PYI program upon recruitment and retention of young scientists, it is clear that the program had no effect upon the 1984 and 1985 cohorts, probably because of the timing of program initiation. The following representative PYI survey verbatim comments underscore this fact.

- I was already an assistant professor when I applied for the PYI program. The program did not exist when I decided to enter academia.
- [The] PYI program did not exist in 1981 when I started my academic career.

Clearly, the program had little chance of influencing academic careers at its beginning. What of the program's **current** effect on graduate students? Tables 16 and 17 show that while, like the sample groups discussed above, graduate students generally favor an academic career, they do not seem influenced by the PYI program. Graduate students verbatim comments indicate that it has little effect because the program is not well known.

- Very frankly, the PYI in my department is not known to most students ... therefore, the fact that he received this award has had little effect on the students in my department ...
- I do not believe the pyi program has been publicized well enough at (institution name) for it to have any effect on the student body. I would like to learn more about the program ...

Apparently, the PYI program did not effect the careers of current PYIs since it was implemented after career decisions were made. According to current graduate students, its current effect upon recruitment of young scientists is negligible, because of its lack of visibility.

4.3 Evaluations of Factors Concerning Academic Positions and the Measurement of Research Success

In the previous section we saw that, despite some preexisting differences in areas of science and/or engineering, career-seeking behaviors for graduate students and predictions of

Table 16

Careers Actively Considered by Graduate Students

	Graduate Students	
	Percent	Count
Actively Considering		
Academic Position	69.1	130
Postdoctoral Position	44.7	84
Industrial Employment	56.9	107
Government Employment	28.2	53

Table 17

Influence of PYI Program Upon Academic Career Choice - Graduate Student Perceptions

	Graduate Students	
	Percent	Count
Has the PYI program discernibly influenced graduate students in your department or on your campus to pursue academic careers?		
Yes	6.7	9
No	93.3	126

their future career were, in the aggregate, the same for PYIs, Finalists, and Grantees. Tables 18 and 19 reinforce this impression and, in fact reveal a remarkable correspondence among groups in their ratings of factors they identified as important considering academic positions and research success.

These tables illustrate the percentages of respondents in each group reporting that a factor is very important in either considering an academic position or in measuring research success. Each row in these tables corresponds to a separate question where respondents rated a factor on a five-point scale ranging from "very important" to "not-at-all important." The rows of these tables have been ordered so that row one corresponds to the question receiving the highest percentage of very important responses from PYIs; the second row contains responses to the question where the second largest percentage of PYIs rated the factor as very important; and the last row reports responses to the factor rated as very important by the smallest percentage of PYIs.

Reviewing the entries in Tables 18 and 19, we see that the structure of factor/criterion importance, as reflected in their relative ordering, is substantially reproduced by each group. In considering factors related to the acceptance of their present (but possibly not their first) academic position, all groups consider research opportunities, and freedom and independence of research as generally very important. Similarly, in Table 19, respondents in each group consistently view the quality of publications, expanding the frontiers of science, and the respect of peer/colleagues as very important in measuring the success of their research.

4.4 Summary

This chapter has discussed the background of the three comparison sample groups, and reviewed the professional career-seeking behaviors of PYIs, Finalists, and Grantees, their expectations regarding the future of their careers, and those factors considered important in evaluating career success. In most circumstances, these groups are similar.

The distributions of males and females, native and foreign born, and educational institutions do not vary greatly among PYIs, Finalists, and Grantees. However, obtaining fellowships is one area where a potentially meaningful distinction may be drawn among the groups: PYIs and Finalists appear to consistently (in the aggregate) obtain a larger proportion of fellowships than do Grantees.

Table 18

Factors Reported as Very Important in Accepting Present Academic Position[1]

	PYIs		Finalists		Grantees	
	Percent	Count	Percent	Count	Percent	Count
Research Opportunities	81.3	218	74.8	83	70.8	97
Freedom/Independence	77.9	208	71.2	79	69.3	95
Research Facilities	55.4	148	53.2	59	43.1	59
Career Prestige	31.1	83	34.2	38	25.0	34
Teaching	26.1	70	24.3	27	29.9	41
Contribution to Society	24.3	65	19.8	22	20.6	28
Location	20.6	55	27.0	30	22.8	31
Personal/Family Factors	16.1	43	16.4	18	21.5	29
Job Security	12.3	33	10.8	12	13.2	18
Salary	6.3	17	10.8	12	8.8	12
Benefits	3.7	10	3.6	4	5.9	8

[1]Factors are sorted by the number of PYIs reporting each as very important.

Table 19

Factors Reported as Very Important in Measuring Research Success[1]

	PYIs		Finalists		Grantees	
	Percent	Count	Percent	Count	Percent	Count
Quality of Publications	89.9	240	82.0	91	86.9	119
Expanding Frontiers of Science	69.2	184	62.4	68	58.4	80
Respect of Peers/Colleagues	55.4	148	55.9	62	52.6	72
Degree of Control Over Research	48.7	128	45.5	50	36.8	49
Extent Research Used by Others	43.8	117	41.4	46	40.9	56
Success of Students in Getting Good Jobs	27.5	73	25.5	28	21.6	29
Success in Getting Research Funding	20.6	55	18.9	21	29.9	41
Number of Students in Research Lab	12.2	32	9.0	10	12.6	17
Number of Publications	12.2	32	13.6	15	11.7	16
Degree to Which Research Advances Career	6.1	16	10.9	12	16.9	23

[1]Factors are sorted by the number of PYIs reporting each as very important.

In the main, by the time their graduate education is ending, members of these sample groups have made a firm decision to enter academia. The existence of the PYI program had no effect upon their decisions, largely because the program was not in existence at the time of their decision. Members of each of the three groups essentially share the same value structure: they aspire to the same careers; they consider the same factors important when considering academic appointments; and they evaluate research success similarly.

5. THE PYI PROGRAM'S EFFECT UPON CAREER PROGRESSION, RESEARCH, AND TEACHING

To this point, the description of the PYI, Finalist, and Grantee respondents has revealed a reasonable comparability in their backgrounds, career paths, and evaluations of factors important to both academic career decisions and evaluating research success. In this chapter we consider the effect of the PYI program upon careers, research, and teaching, as reflected in characteristics of the careers of members of each of the three groups, as well as in the opinions of Department Chairs, Faculty Colleagues, and Graduate Students.

5.1 Effect of the PYI Program Upon Career Progression

The PYI awards translate into a marked effect upon the career progression as reflected in relative professional rank and tenure. As Table 20 illustrates, PYIs are more likely to be tenured than Grantees, and a larger percentage of PYIs are full professors than are either Finalists or Grantees.

This apparent acceleration of the career path for PYIs is most strongly evident when comparing their professional rank with the Grantee respondents' ranks. PYIs are nearly twice as likely to be full professors as are Grantees. In the comparison between PYIs and Finalists, the distinction is not quite so large but it is still statistically significant. When the issue of tenure is considered, PYIs and Finalists exhibit the same status configuration overall and that, together, they are more likely to be tenured than are members of the Grantee group.

It is somewhat surprising that these three groups, so similar in career stage during 1984 and 1985 and each identified as a superior young investigator by NSF, are so dissimilar only five years later. It does appear to be the case, however, that PYI awardees do exhibit a much faster career progression. This observation is even made by the groups naturally least willing to admit such differences. In Table 21 self-reported comparisons of career progressions are presented. While nearly half of Finalists and Grantees reported no difference in the speed of career progression between them and PYIs, approximately 40% did respond that their careers were proceeding at a slower pace than were the PYIs.

Table 20

Professional Rank and Tenure Status

	PYIs		Finalists		Grantees	
	Percent	Count	Percent	Count	Percent	Count
Full Professor	28.7	77	17.1	19	15.3	21
Associate Professor	60.1	161	69.4	77	58.4	80
Assistant Professor	11.2	30	13.5	15	26.3	36
Tenured	82.3	219	82.9	92	68.4	93
Not Tenured	17.7	47	17.1	19	31.6	43

Table 21

Self-Reported Comparative Career Progression

	PYIs Comparing with Contemporaries		Finalists Comparing with PYIs		Grantees Comparing with PYIs	
	Percent	Count	Percent	Count	Percent	Count
Speed of Career Progression						
Much Faster	40.8	107	2.9	3	2.5	3
Faster	46.9	123	11.5	12	13.1	16
No Difference	11.1	29	46.2	48	45.1	55
Slower	0.8	2	28.8	30	27.9	34
Much Slower	0.4	1	10.6	11	11.5	14

A review of written comments on the questionnaire offers an explanation for this finding. In verbatim comments from the 64 Finalists providing elaboration regarding career progression on their questionnaire answers, the greatest number of comments (nearly 40%) stated that PYIs had a distinct advantage in terms of funding and their relative freedom from proposal writing. PYIs, then, are perceived by some to have more advantages in pursuing career-enhancing work.

5.2 Effect of the PYI Program Upon Research

Indications of the effects of the PYI program upon research, as reflected in differences between PYIs and the comparison groups, are illustrated in Tables 22 through 25. Table 22 reports on certain characteristics of research felt to be affected by the PYI program: greater percentages of PYIs report changes in the direction and pace of their research in the past five years than do either Finalists or Grantees. Additionally, the average percentage of PYI research reported to be high risk (i.e., addressing questions or areas of science and/or engineering that reviewers and funding agencies might consider to be controversial or not mainstream) is significantly higher than that reported by Grantees. There is no statistically significant difference in the responses of PYIs and Finalists.

Each of these findings was expected, given the operation of the PYI program. In many ways, the PYI Program is seen to provide an insulation from the normal pressures of seeking research funding -- a window of opportunity, so to speak. By providing a stable base of funding and relief from elaborate renewal requirements, the PYI Program enables young researchers to pursue new or novel research questions, if they so desire. Instead of needing to rely upon a track record in a particular area of science or collaboration with an established senior researchers, the PYI Program is perceived to provide young investigators with the opportunity to freely choose the direction their science will take. This characteristic of the program was identified by several of the PYIs interviewed during site visits as the reason that their research has changed over the period of their award.[1]

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[1] Interestingly, this very characteristic of the PYI award constituted a potential negative effect to some Department Chairs. In commenting about the program generally, during initial site visits, several Chairs commented that PYIs may suffer in the long run by not being exposed to and participating in formal proposal processes and peer review.

Table 22

Reported Characteristics of Research Over Last Five Years

	PYIs		Finalists		Grantees	
	Percent	Count	Percent	Count	Percent	Count
Great Changes in Direction of Research	24.8	66	20.7	23	13.9	19
Great Increase in Pace of Research	50.2	134	49.1	54	41.2	56

	PYIs		Finalists		Grantees	
	Mean	N[1]	Mean	N	Mean	N
Average Percentage of Research That is High Risk	36.9	260	35.1	110	31.5	136

[1]"N" is the total number of nonmissing responses.

Table 23

Average Number and Levels of Support Received Since Obtaining Ph.D.[1]

	PYIs		Finalists		Grantees	
	Mean	N[2]	Mean	N	Mean	N
Mean Number of Grants or Contracts Received From...						
Federal Agencies	4.8	248	4.8	105	5.3	133
State Agencies	0.9	126	1.7	66	1.2	61
Industries	4.5	203	3.3	83	2.5	87
Non-Government Foundations	1.5	142	1.2	62	1.1	73
Universities	1.8	147	2.1	73	2.1	91
Awards	1.2	122	0.9	53	0.8	50
Mean Total Value of Support Received From...						
Federal Agencies	$ 1,016,105	241	$ 692,590	105	$ 599,572	134
State Agencies	86,612	131	171,700	67	81,161	63
Industries	279,832	205	271,186	84	129,355	88
Non-Government Foundations	120,966	147	49,639	61	44,963	74
Universities	40,502	149	31,623	73	33,446	93
Awards	125,430	119	24,986	54	28,404	52

[1]Reported mean numbers of grants and/or contracts and average total monetary value of support were obtained from the survey.
[2]"N" is the total number of nonmissing responses.

Table 24

Presentation, Publication, and Patent Records for PYIs, Finalists, and Grantees[1]

	PYIs		Finalists		Grantees	
	Mean	N[2]	Mean	N	Mean	N
Mean Number of Presentations (Last 5 Years)	23.3	257	19.8	107	17.4	133
Mean Number of Publications (Last 5 Years)	19.8	258	17.9	107	16.4	132
Mean Number of Books Published (Last 5 Years)	1.0	212	0.6	89	0.6	110
Mean Number of Patents (Last 5 Years)	0.5	204	0.6	93	0.2	104

	PYIs		Finalists		Grantees	
	Percent	Count	Percent	Count	Percent	Count
Percentage Publishing No Books	54.2	115	65.2	58	65.5	72
Percentage Obtaining No Patents	72.1	147	75.3	70	82.7	86

[1]Data obtained from survey responses.
[2]"N" is the total number of nonmissing responses.

Table 25

Comparison of PYIs with Their Contemporaries - Research[1]

	Department Chairs Percent	Count	Faculty Colleagues Percent	Count
Compared to Their Contemporaries, PYIs...				
Have a faster start in their research careers	84.1	90	82.9	136
Display greater research productivity	66.4	71	62.8	103
Obtain higher levels of research funding	71.0	76	68.1	111
Produce higher quality research	55.1	59	44.4	72
Have greater independence from senior faculty	58.9	63	50.3	82
Are more likely to pursue "high risk" research	37.4	40	37.2	61
Have a greater tendency to pursue interdisciplinary research questions	23.4	25	25.0	41
Show greater involvement with industry	49.5	53	37.2	61
Are more likely to attract graduate students for research collaboration	56.6	60	51.8	85

[1]PYI contemporaries are faculty members who have received their Ph.D. since 1976.

This explanation does not account for the fact that Finalists display essentially the same degrees of change in direction and pace of their research and report an average percentage of high risk research basically the same as for PYIs. In this and many other areas, Finalists tend to display patterns of activity quite like PYI's patterns and relatively unlike those of Grantees.

In the area of research support, this ordering or relative position among groups emerges again. In Table 23 we see that the overall patterns of funding, as reflected in average number of grants or contracts received, is roughly similar among the three groups. Only in the case of funding from industry are PYIs statistically separated from the other groups (incidentally, Finalists distinguish themselves from Grantees as well, through a greater average receipt of grants and/or contracts from industry).

It is in the area of levels of funding that a clear ordering of the three groups emerges. In the aggregate, PYIs receive higher levels of funding from Federal, industry, foundation, and other award sources. Between the PYI and Grantee funding levels are levels for members of the Finalist comparison group. Interestingly, on the average, members of the Finalist group, while not obtaining total funding at the levels reported by PYIs, substantially match the amounts of funds obtained from industry. In fact, for all three groups, funding from industry constituted the second largest aggregate source of research funding, indicating the importance of industry funding in these areas of science and/or engineering. Worthy of note, given the matching funds provision of the PYI program, is the more substantial funding of PYIs by foundations. As a source of matching funds, it seems clear that PYIs have availed themselves of foundation funding more than have any of the comparison groups. In terms of dollars obtained, PYIs have received well over twice as much funding from this source as have Finalists and Grantees.

The same general pattern is evident when considering scientific productivity. In most circumstances, PYIs display the greatest productivity as reflected in presentations and publications, followed closely by Finalists and then Grantees. While the differences reported in Table 24 are not startlingly large (the differences regarding patents and numbers of books published are not statistically significant), they do conform to an emerging pattern that links similarities between PYIs and Finalists.

In order to obtain relatively independent evaluations of the effects of the PYI program upon research, Department Chairs and Faculty Colleagues were asked to explicitly compare PYIs and their contemporaries on a number of characteristics. Table 25 presents the

percentage of Department Chairs and Faculty Colleagues either agreeing or strongly agreeing with each of nine statements. The greatest agreement is found on statements concerning speed of career progression, funding levels, and research productivity. These findings tend to confirm earlier self-reports regarding career progression and productivity.

5.3 The PYI Program's Effect Upon Teaching Load and Performance

Tables 26 and 27 provide, respectively, background information on the teaching load of, and innovations developed by members of the three comparison groups, as well as the judgments of Department Chair and Faculty Colleague group members regarding the relative characteristics of the teaching careers of PYIs as compared with their contemporaries.

These tables show that there is essentially no difference in either the teaching load or performance of PYIs, Finalists, and Grantees. In averaging the number of courses and students taught per academic year over the past three years, the only statistical difference that emerges is between the number of undergraduate students taught by PYIs and Finalists. While this single difference may provide an indicator as to the size of the departments they are teaching in, it does not appear to signify a difference that can be interpreted within the patterns already observed.

Regarding teaching load and innovations, Table 26 shows that, in the aggregate, there is a basic parity between members of the three comparison groups. In addition, spillovers from research activities are no more likely to occur for PYIs than in any of the other groups. Table 28, which reports explicit comparisons between PYIs and their contemporaries, provides no indications that the teaching circumstances of PYIs differ from those which would be expected of other faculty at their stage of professional development.

Department Chairs and Faculty Colleagues generally differ on whether PYIs experience a different teaching or advising environment than do their contemporaries. In only two areas do approximately one-third of Department Chairs or Faculty Colleagues perceive that PYIs exhibit a difference from their contemporaries. Verbatim comments by Department Chairs

Table 26

Background Information - Teaching

	PYIs		Finalists		Grantees	
	Mean	N[1]	Mean	N	Mean	N
Mean Number of Courses Taught from 1985-1988						
Undergraduate Level	1.4	206	1.5	89	1.5	121
Graduate Level	1.4	206	1.4	89	1.5	112
Mean Number of Students Enrolled in Courses from 1985-1988						
Undergraduate Level	91.9	211	67.2	90	74.7	117
Graduate Level	26.2	206	22.9	93	23.3	111
Mean Number of New Courses Developed in the Last 5 Years as a Result of Your Research	1.5	241	1.5	101	1.5	120
Mean Number of New Course Materials Developed in the Last 5 Years as a Result of Your Research	1.3	189	1.6	78	1.4	90

[1]"N" is the total number of nonmissing respondents.

Table 27

Comparison of PYIs with Their Contemporaries - Teaching[1]

	Department Chairs		Faculty Colleagues	
	Percent	Count	Percent	Count
Compared to Their Contemporaries, PYIs...				
Have a lighter teaching load	34.0	36	37.8	62
Attract more students to their courses	14.2	15	11.0	18
Develop more new courses	12.3	13	11.0	18
Develop more new course materials (e.g., books, films, models, computer programs, etc.)	13.2	14	12.8	21
Attract more graduate students as dissertation committee members	29.5	31	32.3	52
Are more active in curriculum development	12.3	13	7.9	13

[1]PYI contemporaries are faculty members who have received their Ph.D. since 1976.

regarding the place of teaching in their institutions provides a likely context for interpreting the lack of PYI program effect upon teaching.

- We are primarily a research unit with modest teaching responsibilities.
- Teaching is considered important and valued but it does not match research as a criterion for tenure or raises.
- We work hard at it, but it is much harder to verify and compare quality teaching.

Teaching, then, while more or less important within a department, is not as strongly emphasized or comparatively used, in making tenure decisions generally. It makes sense, therefore, that in teaching or advising students, PYIs are different from other faculty at similar stages of their academic career. Graduate students also generally hold this opinion, as illustrated in Table 28.

5.4 Summary

Reviewing the self-reported effect of the PYI program upon career progression, research, and teaching provides a mixed assessment. In their careers, PYIs are clearly progressing at a rate exceeding those of either the Finalist or Grantee sample groups. PYIs are more likely to be full professors than Finalists or Grantees, and are more likely to be tenured than are Grantees. Considering research funding and productivity, PYIs also appear to be in an advantageous position vis a vis Finalists and Grantees. On the average, PYIs receive a higher level of grant and contract funding. It is also important to note that the structure of their funding is different as well: PYIs obtain significantly more funds, on average, from non-government foundations and other awards than Finalists and Grantees do.

In the area of teaching, however, there is little evidence of programmatic influence. Except in the reporting of undergraduate class sizes, there are no significant differences in self-reported teaching characteristics. This impression is reinforced by the comparisons by Department Chairs and Faculty Colleagues of PYIs and their contemporaries. In comparing PYIs and contemporaries on teaching load, attracting students, and curriculum development, no significant differences are reported. The effect of the PYI program, while clear in the area of

Table 28

Graduate Student Comparison of PYIs with Their Contemporaries[1]

	Graduate Students	
	Percent	Count
Compared to Their Contemporaries, PYIs...		
Have a faster start in their research careers	73.6	89
Show more extensive involvement with industry	28.1	34
Are more likely to attract graduate students for research collaboration	59.2	71
Attract more students to their courses	19.8	24
Attract more graduate students as dissertation committee members	29.8	36

[1]PYI contemporaries are faculty members at comparable points in their careers.

career progression and research characteristics, does not extend to the PYIs teaching career. This is not unexpected given the relative weight accorded research and teaching in the making of tenure and promotion decisions as reflected in Department Chairs' comments.

6. PYI, FINALIST, AND GRANTEE COOPERATION WITH INDUSTRY

The effect of a unique PYI program impact upon fostering cooperation between industry and academia (as measured by the frequency of interactions between PYIs or their research teams with industry researchers) appears unlikely, in light of survey responses made by PYIs, Finalists, and Grantees. If measured by research consulting with industry, the program also appears not to have made a measurable impact at least as PYIs are compared to the activities of Finalists and Grantees. As a check on these reported interactions and benefits, the responses to similar questions asked of Industry Contacts were reviewed. These tended to reinforce the impression obtained from the comparisons groups.

Tables 29 and 30 report the frequency of industry interaction and consulting for the PYI, Finalist, and Grantee groups. In all but one category, PYIs report fewer frequent contacts with industry or a lower extent of industry consulting. Confounding this is the finding that most often the group reporting the greatest contact with industry is Finalists. While these differences are not statistically significant, it is contrary to what might be expected given the funding differentials observed above among the groups. PYIs, while securing the greatest aggregate average funding from industry, appear to have no greater contact with their sponsors.

The high degree of interaction that all groups report may possibly explain the similarity in the frequency of industry interaction among groups that might be drawn if we note that PYIs, Finalists, and Grantees share the same levels of expectation regarding working with industry. It stands to reason, then that they would also share similar expectations regarding the extent of such interaction. In reporting telephone conversations and correspondence with industry researchers, over half of the respondents in each group stated that such contact was often made. Less than 5% reported never having such contact. With such interaction being the norm rather than the exception, it appears that the PYI program is not so much facilitating a new activity as perhaps channeling a common activity.

Since consulting and interaction with industry are prevalent features of the academic careers for PYIs, Finalists, and Grantees. What is industry gaining from this relationship? Table 31 presents the three sample groups' self-reported benefits to industry as recorded by the three sample groups. Here, as previously, we find that PYIs and Finalists distinguish themselves from Grantees. For example, PYIs and Finalists report a statistically higher percentage of

Table 29

Reported Frequency of Interaction with Industry

	PYIs		Finalists		Grantees	
	Percent	Count	Percent	Count	Percent	Count
Respondent Conducts Research at Industrial Facility						
Often	8.7	20	17.0	16	11.1	10
Seldom	33.3	77	28.7	27	32.3	29
Never	58.0	134	54.3	51	56.7	51
Respondent's Research Group Members Conduct Research at Industrial Facility						
Often	12.6	29	19.1	18	11.1	10
Seldom	37.3	86	32.9	31	38.9	35
Never	50.2	116	47.9	45	50.0	45
Industrial Researchers Work at University Facility						
Often	10.9	25	10.6	10	11.1	10
Seldom	36.5	84	41.5	39	31.1	28
Never	52.6	121	47.9	45	57.8	52
Respondent in Contact with Industrial Researchers (Telephone Call, Correspondence, etc.)						
Often	67.1	157	63.8	60	54.9	50
Seldom	28.2	66	31.9	30	45.1	41
Never	4.7	11	4.3	4.0	0.0	0

Table 30

Reported and Projected Industrial Research Consulting

	PYIs		Finalists		Grantees	
	Percent	Count	Percent	Count	Percent	Count
Extent of Industrial Consulting - Last 5 Years						
Great/Moderate Extent	28.9	68	34.0	32	27.5	25
Some/Lesser Extent	54.0	127	54.2	51	61.6	56
Not-At-All	17.0	40	11.7	11	11.0	10
Extent of Industrial Consulting - Future 5 Years						
Great/Moderate Extent	35.5	81	40.7	37	40.4	36
Some/Lesser Extent	54.4	124	56.1	51	56.1	50
Not-At-All	10.1	23	3.3	3	3.4	3

Table 31

Reported Benefits to Industrial Contacts

	PYIs		Finalists		Grantees	
	Percent	Count	Percent	Count	Percent	Count
Technology Transfer						
Great/Moderate Extent	44.6	103	49.5	45	35.3	30
Some/Lesser Extent	31.2	72	34.1	31	45.9	39
Not-At-All	24.2	56	16.5	15	18.8	16
Knowledge Transfer						
Great/Moderate Extent	63.1	147	72.8	67	59.1	52
Some/Lesser Extent	27.9	65	22.8	21	37.5	33
Not-At-All	9.0	21	4.3	4	3.4	3
Patents						
Great/Moderate Extent	6.7	15	9.0	8	4.9	4
Some/Lesser Extent	14.7	32	19.1	17	14.7	12
Not-At-All	79.0	177	71.9	64	80.5	66
Joint Publications						
Great/Moderate Extent	17.7	40	23.1	21	18.6	16
Some/Lesser Extent	32.7	74	34.1	31	36.0	31
Not-At-All	49.6	112	42.9	39	45.6	39

technology and knowledge transfer. This pattern does not unambiguously suggest an independent effect of the PYI program as Finalists, not PYIs, more frequently reported the greatest extent of technology and knowledge transfer.

Responses from Industry contacts reinforce these general observations. Tables 32, 33, and 34 report upon the frequency of interaction with PYIs, corporate collaboration generally, and industry benefits from the PYI program. The percentages in these tables roughly reproduce those observed above. The greatest degree of interaction with PYIs takes place through correspondence or telephone conversation. Interestingly, Industry contacts are more likely to cite interaction as taking place at industry facilities than are the PYIs. While the actual percentages vary, Industry contacts report similar patterns of benefits to industry as a result of the PYI program (though the relative ranking of technology and knowledge transfer are reversed).

These responses should not be considered a poor evaluation of the program by any means, however. In open-ended comments regarding the program, Industry Contacts included the following representative statements:

- A win-win program for both the PYI and the corporation.
- [The program is a] Very positive mechanism for getting highly capable researchers in contact with industry.
- A convenient way to support riskier research that may help us all.

Summary

Reviewing survey findings, we can see little evidence to support a contention that the PYI program uniquely fosters cooperation between academia and industry. While PYIs generally receive more funding from industries, non-governmental foundations, and other awards, than Grantees or Finalists do, this increased funding is not reflected in increased interaction. PYIs, Finalists, and Grantees all report about the same extent of interaction with industry and project roughly similar expected levels of interaction in the future.

Table 32

Industry Reports of Frequent Interaction with PYIs by Type of Contact

	Industrial Sponsors	
	Percent	Count
PYI Conducts Research at Industrial Facility	15.8	27
Member(s) of PYI Research Group Use Industrial Facility	10.8	18
Industrial Researcher's Use PYI's Facilities	10.7	18
Industrial Researchers in Contact by Telephone/Correspondence	62.9	107

Table 33

Seeking Research Collaboration - Industrial Sponsors

	Industrial Sponsors	
	Percent	Count
Frequently Seek Collaboration With...		
PYIs	46.2	79
Other academic researchers	61.5	107

Table 34

Industrial Sponsor Reports of Benefits to Industry

	Industrial Sponsors	
	Percent	Count
Reporting Great/Moderate Extent of...		
Technology transfer	65.7	109
Knowledge transfer	42.4	72
Patents	4.8	8
Joint publications	26.5	44

7. PYI PROGRAM EVALUATIONS PROVIDED BY PYIs, FINALISTS, GRANTEES, DEPARTMENT CHAIRS, FACULTY COLLEAGUES, GRADUATE STUDENTS, AND INDUSTRY CONTACTS

In this chapter, opinions regarding the positive effects of the PYI program and the degree to which it has been successful in meeting stated objectives are presented. The responses presented in the first section of this chapter were obtained from closed-ended questions contained in the questionnaire. The second section of this chapter presents a summary of the evaluations, issues, and recommendations made in response to the questionnaire's open-ended questions.

7.1 Tabular Evaluations

Though responses are presented for all seven sample groups, the greatest weight in this section is given to responses provided by the Department Chair and Faculty Colleague groups. Senior faculty and especially Department Chairs can be expected to be more completely informed as to the effects of NSF's PYI Program. Also, the Department Chair and Faculty Colleague groups do not have the special interest in the program or personal performance that can be expected from PYIs or the competitive positioning shared by Finalists and Grantees.

Tables 35 and 36 present the percentages of respondents reporting that the PYI program has had a positive effect in each of 13 areas for their department and university. The responses from the Department Chair and Faculty Colleague groups show that they believe most frequently that the PYI Program positively effects research. Cited as areas of positive influence are the "Quality, Pace, and Atmosphere of Research," "Academic Research Reputation," and "Research Capabilities." Clearly, the PYI Program is most frequently recognized for its research-enhancing characteristics. Also identified as an area of positive influence was "Academic/Industry Cooperation."

An examination of those areas where the PYI Program is less frequently noted as having a positive effect reveals that these are concerned with teaching, collaboration among faculty, and attracting students generally. Teaching, as was noted in Chapter 5, does not appear to be affected by the PYI Program and so this rating by Department Chairs and Faculty Colleagues

Table 35

Reported Positive Effects of PYI Program Upon Departments

	Finalists		Grantees		Department Chairs		Faculty Colleagues	
	Percent	Count	Percent	Count	Percent	Count	Percent	Count
Quality, Pace, and Atmosphere of Research	27.0	27	28.8	36	65.3	66	61.1	88
Quality, Pace, and Atmosphere of Teaching	8.1	8	5.7	7	19.8	20	17.9	26
Ability to Attract and Retain Faculty	22.0	22	23.4	29	53.0	53	45.8	66
Academic and Research Reputation	45.5	46	43.2	54	77.2	78	67.4	97
Research Capabilities	35.0	35	36.3	45	65.3	66	59.4	85
Ability to Attract More Students	17.8	18	15.3	19	30.7	31	32.4	46
Enhance Funding From:								
National Science Foundation	21.3	20	18.9	23	42.4	42	39.1	54
Other Government Sources	14.1	13	9.7	11	32.0	31	27.6	37
Foundations	11.2	10	12.3	14	29.9	29	27.3	35
Industry	31.6	30	35.8	43	68.0	66	56.0	75
Collaboration Among Faculty	5.0	5	8.9	11	20.0	20	22.2	32
Increased Graduate Enrollment	11.1	11	10.5	13	22.0	22	25.7	37
Academic/Industrial Cooperation	28.3	28	33.9	42	64.0	64	52.8	75

Table 36

Reported Positive Effects of PYI Program Upon University

	Finalists		Grantees		Department Chairs		Faculty Colleagues	
	Percent	Count	Percent	Count	Percent	Count	Percent	Count
Quality, Pace, and Atmosphere of Research	28.2	20	32.3	30	61.8	55	45.6	57
Quality, Pace, and Atmosphere of Teaching	11.0	8	7.7	7	12.6	11	9.5	12
Ability to Attract and Retain Faculty	22.9	16	25.8	24	48.3	42	35.8	44
Academic and Research Reputation	47.9	34	45.7	43	70.5	62	59.7	74
Research Capabilities	25.4	18	31.2	29	59.3	51	48.0	59
Ability to Attract More Students	15.5	11	16.1	15	27.6	24	22.8	28
Enhance Funding From:								
National Science Foundation	20.9	14	18.6	16	42.0	34	35.7	41
Other Government Sources	19.7	13	11.3	9	28.2	22	23.0	26
Foundations	15.6	10	10.0	8	28.2	22	22.5	25
Industry	30.3	20	30.6	26	51.9	41	47.4	54
Collaboration Among Faculty	8.7	6	8.6	8	11.1	9	1..1	20
Increased Graduate Enrollment	13.2	9	13.0	12	16.9	14	21.4	25
Academic/Industrial Cooperation	29.4	20	31.9	29	54.9	45	48.3	56

underscores the earlier finding. As for collaboration with faculty, the insulation the PYI award can provide from the normal pressures exerted on new faculty makes the evaluations observed in Tables 35 and 36 reasonable.

Finalists and Grantees as well as Department Chairs and Faculty Colleagues. reported positive effects (though the magnitude of responses by Finalists and Grantees were much lower).

Table 37 presents the percentage of respondents in all seven sample groups that agree the PYI Program has been successful in meeting five of its stated objectives. The patterns across all groups display certain expected characteristics such as relatively high agreement among PYIs and lower percentages of agreement among Finalists and Grantees. In the two most presumably knowledgeable and unbiased groups there is a general consensus that the PYI Program is not generally successful at attracting outstanding Ph.D.'s to academia. The majority of Department Chairs and faculty colleagues also believe that the program contributes to retention. The most positive evaluation of the PYI program for these groups was in the area of improving research capabilities. The program is considered by most Department Chair and Faculty Colleague respondents to have a salutary effect on the research capabilities of academic institutions.

It is in evaluating the effects of the PYI program on promoting cooperation and funding from the private sector that Department Chair and Faculty Colleague opinions differ most markedly. Department Chairs are much more likely to agree that the program has been successful in fostering cooperation and funding. Faculty Colleagues are less likely to report success in these areas. The greatest discrepancy in responses by these two groups occurs when considering the success of the program in the areas of funding from the private sector and academic/industry cooperation. Faculty Colleagues are much less likely than Department Chairs to state that the PYI Program is successfully meeting its objectives in those areas.

7.2 Comments and Suggestions

The majority of information presented to this point in this report has been taken from responses to close-ended survey questions, CVs, or NSF administrative fiscal records. This section concentrates exclusively upon the written comments obtained from respondents. These comments

Table 37

Respondents Agreeing that PYI Program Has Been Successful

	PYIs		Finalists		Grantees		Department Chairs		Faculty Colleagues		Graduate Students		Industry Contacts	
	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count
Respondents Reporting PYI Program Success At:														
Attracting outstanding young Ph.D.s to academia	50.4	129	16.8	18	20.5	26	25.8	33	28.5	49	31.9	45	45.7	79
Retaining outstanding young Ph.D.s in academia	70.3	182	36.1	39	38.6	49	56.2	72	52.3	90	46.8	66	66.1	115
Improving research capabilities of academic institutions	72.3	188	40.2	43	48.8	61	63.3	81	56.4	97	61.0	86	66.7	116
Promoting research funding from the private sector	63.2	165	36.7	40	44.0	55	63.0	80	41.9	72	31.9	45	66.1	115
Promoting cooperation between academia and industry	60.1	158	33.9	37	35.5	44	55.1	70	34.3	59	22.0	31	64.9	113

provide an important source of insight into how the different sample groups evaluate the PYI program. Five general topics are covered including:

- Positive evaluations of the PYI program.
- Insufficient support in acquiring industry support.
- The PYI award as a barrier to additional funding.
- Criticism of PYI selection criteria.
- Industry Contact recommendations for the PYI program.

Positive Evaluations

While much of what is related in this section concerns criticisms of and recommendations for the PYI program, there were many positive evaluations expressed as well. Naturally, PYIs were the most consistently positive in their evaluations of the program in statements such as the following:

- It [the PYI program] provided a major boost to my career because of the support it provided to pursue promising research areas without having to write a detailed proposal to attempt to secure funding.
- Very good program - minimal red tape required for core (base funding) amount ... a great start to my career.

Positive evaluations were not restricted to PYIs, though. Among the remaining academic sample groups, Department Chairs were generally the most positive in their views toward the PYI program.

- The PYI program is an excellent program. It has served this department very well.
- Excellent program. Needs sustained funding. Industry support has been fundamental to the success enjoyed ... Government support should increase and be recognized for its leveraging potential as well as a key element in their own research program.

- The PYI program has made positive contributions in that (1) it has provided generally bright young faculty with research support, and (2) it has promoted industrial contact between faculty and industry at the early growth period of the faculty's career.

Finalists, Grantees, and Faculty Colleagues were generally less positive in their evaluations of the PYI program. Graduate Students only infrequently provided evaluations of the program, presumably because their lack of familiarity with the program. In the comments section of the questionnaire, one Graduate Student remarked that, "As I filled out this questionnaire I realized I know next to nothing about this program. All I know are two people that are PYIs but I don't know what that means or how one becomes a PYI."

Insufficient Support in Obtaining Industrial Funding

A common programmatic difficulty reported by PYIs was the obtaining of industrial matching funds. Many PYIs felt that too much time was being spent on the process of securing matching funds and too little on actual research. In addition, they felt too much "on their own." In response to this perceived circumstance, a variety of recommendations were made. Representative of the recommendations are the following:

- Try to make certain that the sponsoring universities at least accept a percentage of the responsibility for raising matching funds. I received token acknowledgement from university administrators concerning the PYI and absolutely no help raising funds or making contact with possible industrial supporters.
- If possible, more assistance could be given to PYIs in the commercial research area. Lists of previously participating industrial contacts would be helpful; also a brochure and introductory letter that PYIs could send out would be helpful.
- Print a small information booklet on the purpose, structure, criteria, and selectivity of the program for use when approaching industry.

PYIs, as these comments indicate, would generally like more direct support from both their universities and departments as well as NSF in obtaining industry matching funds.

The PYI Award as an Obstacle to Additional Funding

Another common funding theme mentioned by PYIs concerned the impact of the PYI award upon future or additional funding. Some PYIs speak of an appearance of an obstacle:

- Rumors persist that PYI awardees are at a disadvantage in applying for other NSF funds.

Others recount incidents in which they were turned down for additional funding as a consequence of having a PYI award:

- The NSF program directors I have dealt with definitely take the PYI award into account when considering other NSF Grants. A common criticism of a number of unsuccessful proposals was that my funding was already adequate. In one case the program officer told me that I would have been funded if I didn't have the PYI.
- I directly lost a pending NSF award and was told by NASA that they didn't need to fund me because I could do the work with PYI funds.

Just slightly less than half of all PYIs commenting upon how the PYI award has helped or hindered their ability to obtain research funds replied that the award has hindered them. Such comments were not restricted to PYIs, however. The following comments by (in order) Department Chairs and Grantees show that the perception of difficulty in obtaining additional funding extends to other sample groups:

- PYIs are discouraged, at least lately, from applying to NSF for other grants. I feel this is a poor response from NSF.
- I don't think PYIs are useful in our institute, it [the award] might jeopardize the awardees getting another grant from NSF.

The Selection Process, Peer Review, and Award Diversity

The aspect of the PYI program that was criticized most frequently by Department Chairs, Faculty Colleagues, Finalists, and Grantees was the process of PYI selection and lack of peer review. Many respondents in these groups expressed reservations about the process as well

as the eventual consequences of this process to PYIs. Representative verbatim comments by Department Chairs include:

- I believe that the PYIs should be based on a comprehensive proposal of 10-15 pages written by the applicant. Use of letters of recommendation and resumes as it is currently done is too much of an "old boys" club syndrome.
- Forget the industrial [matching] requirements and merge program with engineering initiation grants. PYIs are perceived ... to be based on pedigree, not quality or capability.
- The program should focus on young faculty 3-4 years from their Ph.D. to provide a better view of their capabilities and performance.
- Extend the program to a greater diversity of universities. A relatively few universities dominate PYI selection.

Finalists and Grantees were no less critical of the selection process (as they understood it). The themes constantly returned to in their written comments included:

- My main complaint about the PYI program is the manner in which awardees are chosen. No review process of any proposed research is made of any of the nominees. A PYI seems to be awarded to those who either have a great letter of recommendation from the department chair, comes from a renown school, has a brilliant resume, or some combination of these. It is not awarded necessarily to the person who has demonstrated research strength ... (Grantee)
- In my opinion, the PYI program should be abandoned. The PYI funds should be redirected into a revitalized research initiation grant program (RIG). I was, and remain, a strong supporter of the RIG program because of peer review of genuine research proposals - not just resumes. (Grantee)
- Unfortunately, the perception of those at schools that are not "big name" schools (e.g., MIT, Cal Tech, Princeton, etc.) is that the PYI program is nothing but a pedigree ... show. ... My personal opinion is that any grant program which is not merit-based ... is neither serving the academic community nor the PYI very well. Young academics need the feedback that comes with writing and submitting a proposal. (Finalist)

While in the distinct minority of PYIs, one PYI provided perhaps the clearest statement of the utility of the proposal process and what PYIs may be missing.

- People complain about the exercise of ... proposal writing. However, I find it quite useful. When I write a regular proposal, I am forced to sit down every couple of years and think about where my research program is going and how it

impacts the outside world. I also get the benefit of outside reviews. The PYIs are missing that. They also do not learn what it takes to sell your work.

Industry Contact Recommendations

Industry Contacts did not share the reservations other sample groups expressed about the PYI selection process. Instead, Industry Contacts focused primarily on issues they felt would either promote the visibility of the PYI program or actions that NSF might undertake to assist corporate involvement in the program. The following presents a sampling of the recommendations made by Industry Contacts.

- Publicize.
- Get the word out to industry.
- More visibility of these programs is needed at lower levels in private industry.
- An annual symposium that highlights some of the various on-going PYI programs would be beneficial.
- Get information on research interests of PYIs to industry quicker.
- ... having access to list of PYI applicants and award recipients would provide an opportunity for our department to initiate contact on things of interest. As presently conducted, we are required to wait for the PYI to contact us.
- NSF should be more organized and able to provide important statistics to industry and\or academia upon request. NSF should not change due dates for matching funds submission (some PYIs are October, some May, some June). PYI listings should be available electronically or at least on disk.
- I recommend that the NSF assist in overseeing the partnerships more closely. In the case of (firm name), either (1) the PYIs were ignored, receiving on a check and a form letter each year, (2) PYIs were allowed to ignore (firm name), barely contributing as much as a status report each year, or (3) PYIs were matched with groups with much too narrow a focus, forcing PYIs into virtual commercial development of products under ridiculous deadlines.

As these comments indicate, Industry Contacts are concerned about the visibility of the program and the ability of NSF to facilitate their participation in the PYI program.

Summary

When considering the effects of the PYI program upon their departments and universities, Department Chairs and Faculty Colleagues are in general agreement. The majority of respondents in each group considers the program to have had positive effects upon the research quality, capabilities, and reputation of their departments and universities. This positive assessment also extended to the ability to secure industry funding. The PYI program was not to customarily considered to have a positive effect on teaching, enrollments, or collaboration among faculty, however.

When the context of these questions changed from a consideration of the specific effects of the program to the abstract success of the program in meeting goals, Department Chairs and Faculty Colleagues expressed somewhat different views. Rating the success of the program in promoting funding and cooperation with industry, Department Chairs remained positive for the most part. A majority of Faculty Colleagues, though, did not believe the program has been successful in this area. The difference in these evaluations is thought due to the perspective and knowledge members of each group bring to these questions. Current Department Chairs, by virtue of their office, can be considered to have a wider perspective and perhaps wider knowledge when considering programmatic issues. Department Chairs and Faculty Colleagues agree that the PYI program is not generally successful in attracting outstanding Ph.D.'s to academia.

When provided with an open-ended forum to express opinions and recommendations vis a vis the PYI program, the sample groups clearly distinguish themselves. PYIs are the most uniformly positive in commenting upon the program. PYIs do comment upon some problems they are experiencing, however. They cite a lack of assistance in obtaining industry matching funds and barriers in securing additional academic funding as problems.

Department Chairs, Finalists, and Grantees provide a somewhat more critical view of the PYI program. A large proportion of each group identified what they considered problems in the PYI selection process and were critical of the results of this process. Recommendations made by Industry Contacts tended to focus upon the need to make the program generally more visible to industry and ways in which NSF could facilitate their participation. Graduate Students, due to their lack of knowledge about the program, expressed few opinions about the PYI program.

APPENDIX A

BACCALAUREATE DEGREE INSTITUTIONS FOR PYIs, FINALISTS, AND GRANTEES

Table A1

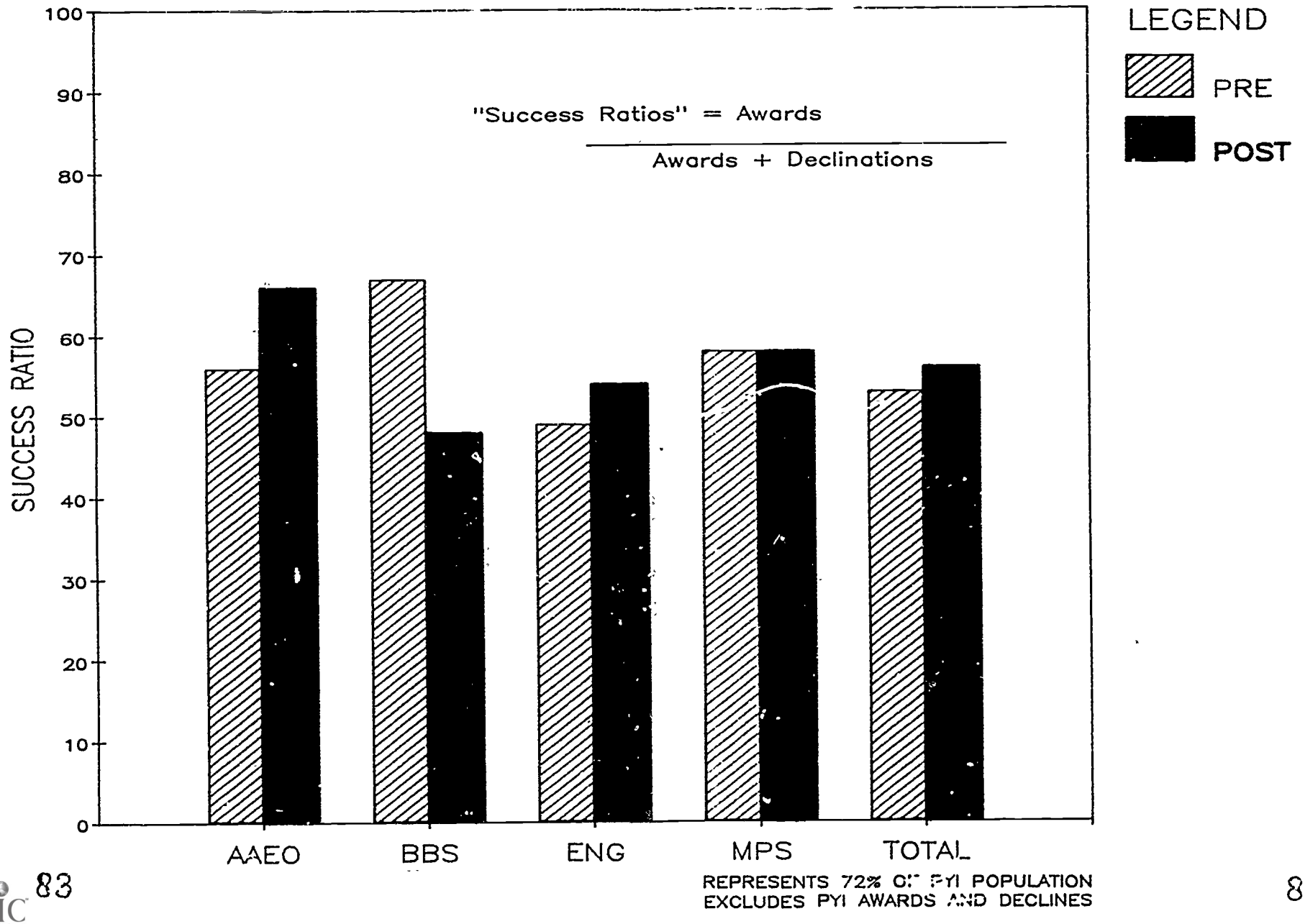
Baccalaureate Degree Institutions for PYIs, Finalists, and Grantees[1]

INSTITUTIONS CITED	PYIs		FINALISTS		GRANTEES		TOTAL
EIGHT OR MORE TIMES	Percent	Count	Percent	Count	Percent	Count	Count
BROWN UNIV	1.67	4	5.26	5	1.75	2	11
CALIF INST TECH	2.50	6	3.16	3	0.88	1	10
CALIF, UNIV BERKELEY	4.17	10	1.05	1	1.75	2	13
CORNELL UNIV	2.50	6	3.16	3	.	.	9
HARVARD UNIV	2.50	6	3.16	3	4.39	5	14
ILLINOIS UNIV	2.08	5	1.05	1	1.75	2	8
INDIAN INST SCI	2.50	6	2.11	2	2.63	3	11
MASS INST TECH	5.42	13	4.21	4	0.88	1	18
MICHIGAN, UNIV OF	1.67	4	1.05	1	3.51	4	9
NAT TAIWAN UNIV	0.83	2	6.31	6	3.51	4	12
PRINCETON UNIV	2.92	7	1.05	1	.	.	8
STANFORD UNIV	2.50	6	1.05	1	0.88	1	8
WISCONSIN UNIV	0.83	2	3.21	4	1.75	2	8
NUMBER OF TIMES REMAINING INSTITUTIONS CITED							
SIX TIMES	1.67	4	.	.	1.75	2	6
FIVE TIMES	6.67	16	10.53	10	7.89	9	35
FOUR TIMES	2.50	6	3.16	3	2.63	3	12
THREE TIMES	9.58	23	13.68	13	13.16	15	51
TWO TIMES	18.75	45	15.79	15	14.04	16	78
SINGLE TIME	28.75	69	20.00	19	36.84	42	130
TOTAL	53.45	240	21.16	95	25.39	114	449

[1]Information obtained from PYI, Finalist, and Grantee CVs. Zeros replaced with ".".

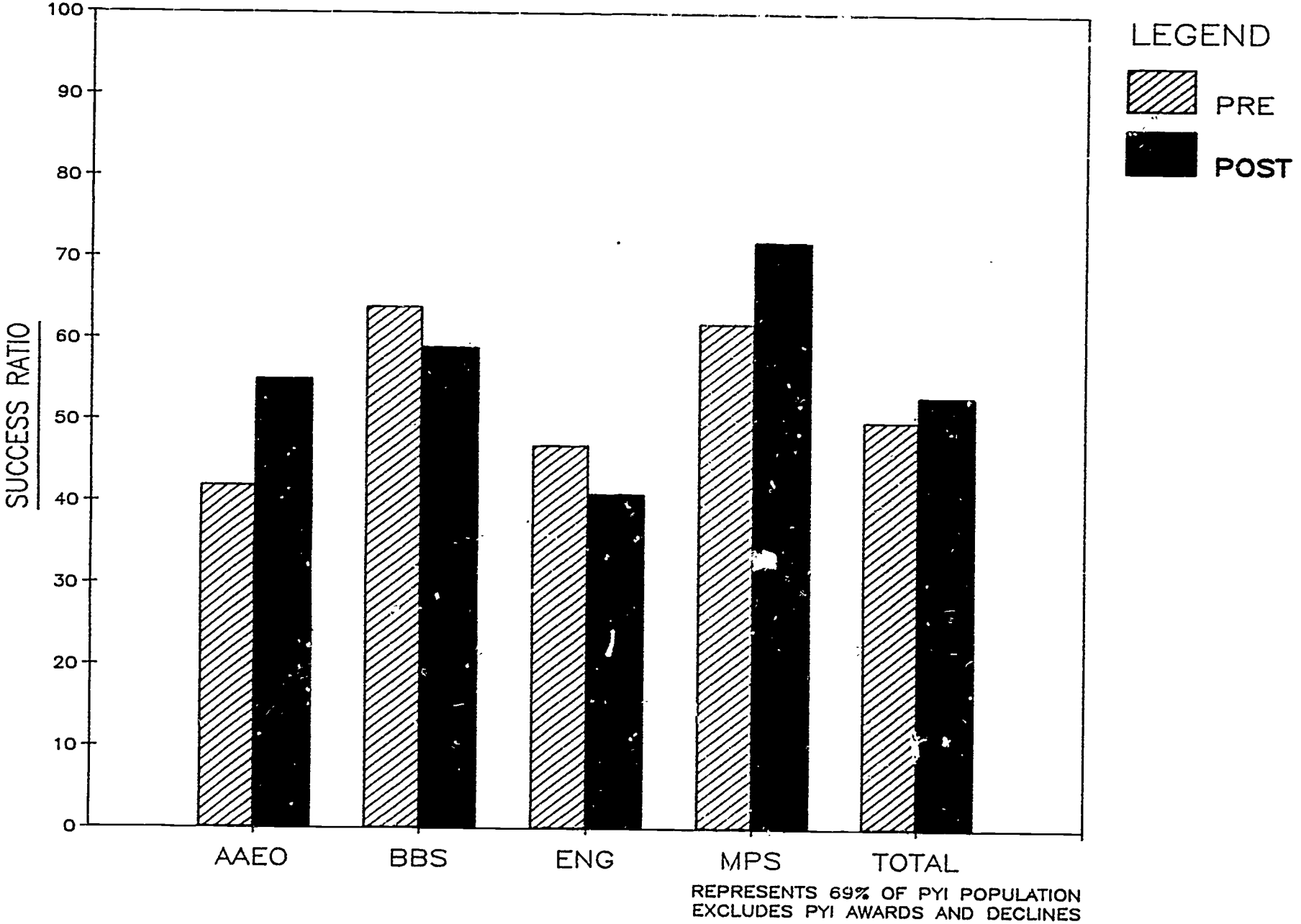
B-1. PYI "Success Ratios" For Proposals (Other than PYI Nominations)

FY 1984 PYI PROPOSAL HISTORY



REPRESENTS 72% OF PYI POPULATION
EXCLUDES PYI AWARDS AND DECLINES

FY 1985 PYI PROPOSAL HISTORY



REPRESENTS 69% OF PYI POPULATION
EXCLUDES PYI AWARDS AND DECLINES

B2. PYIs Having at Least One NSF Research Grant Prior to their PYI Award

	FY 84 "Class"		FY 85 "Class"	
	w/prior awds	Total PYIs	w/prior awds	Total PYIs
AAEO/AST	2	5	0	4
ATM	1	1	1	1
EAR	3	6	6	10
OCE	2	2	0	0
	8	14	7	15
BBS/BNS	0	3	2	5
BSR	2	2	1	3
DCB	3	11	2	10
DMB	2	8	1	6
IST	2	2	0	2
SES	0	0	1	1
	9	26	7	27
ENG/CBTE	20	22	17	22
DMCE	4	7	10	18
ECES	16	26	8	20
ECSE	13	20	8	19
MSME	12	20	14	20
	65	95	57	99
MPS/CHEM	7	13	4	12
DCR	7	12	7	11
DMR	7	11	6	13
DMS	4	7	3	10
PHY	4	12	3	12
	29	55	23	58
	111	190	94	199
	111/190= 58.4%		94/199= 47.2%	

APPENDIX B3 Expansion of NSF Directorate and Division Names, FYs 1985, 1986

Abbreviation	Organization
AAEO	Astronomical, Atomospheric, Earth and Ocean Sciences
AST	Astronomical Sciences
ATM	Atmospheric Sciences
EAR	Earth Sciences
OCE	Ocean Sciences
BBS	Biological, Behavioral and Social Sciences
BNS	Behavioral and Neural Sciences
BSR	Biotic Systems and Resources
DCI	Cellular Biosciences
DMI	Molecular Biosciences
IST	Information Science and Technology
SES	Social and Economic Sciences
ENG	Engineering
CBTE	Chemical, Biochemical, and Thermal Engr
DMCE	Design, Manufacturing, and Computer-Integrated Engr
ECES	Emerging and Critical Engineering Systems
ECSE	Electrical, Communications, and Systems Engr
MSME	Mechanics, Structures, and Materials Engr
MPS	Mathematical and Physical Sciences
CHEM	Chemistry
DCR	Computer Research
DMR	Materials Research
DMS	Mathematical Sciences
PHY	Physics

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