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ABSTRACT

This 1980 profile provides an overview of employment stability and change among a small random sample of U.S. and Canadian members of The American Institute of Physics (AIP) member societies: The American Physical Society; Optical Society of America; Acoustical Society of America; The Society of Rheology; American Association of Physics Teachers; American Astronomical Society; American Crystallographic Society; American Association of Physicists in Medicine; and American Vacuum Society. Specific topics presented in the text and illustrated in charts and graphs include: employment 1980; subfields; salaries; employment 1979-80; salary increases 1979-80; employment and salary changes 1979-80; and society membership profiles. Five appendices include: (1) detailed statistical tables on 1980 demographic and employment characteristics, 1980 salaries, and 1979-80 salary comparisons; (2) a list of geographic regions; (3) dropping society membership; (4) methodology used in the survey; and (5) a list of definitions and technical notes. (SK)

AIP **report** MANPOWER STATISTICS DIVISION

American Institute of Physics, 335 East 45 Street, New York N.Y. 10017 (212) 661-9404

SOCIETY MEMBERSHIP 1980 PROFILE: STABILITY AND CHANGE

Beverly Fearn Porter and Roman Czujko

American Physical Society
Optical Society of America
Acoustical Society of America
The Society of Rheology
American Association of Physics Teachers
American Crystallographic Association
American Astronomical Society
American Association of Physicists in Medicine
American Vacuum Society

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Member Societies

The American Physical Society
Optical Society of America
Acoustical Society of America
The Society of Rheology
American Association of Physics Teachers
American Crystallographic Association
American Astronomical Society
American Association of Physicists in Medicine
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Introduction

While stability marks the tenor of scientific employment, changes, sometimes dramatic but more typically gradual, do occur. This 1980 profile provides an overview of such patterns of stability and change among members of the AIP member societies: The American Physical Society, Optical Society of America, Acoustical Society of America, The Society of Rheology, American Association of Physics Teachers, American Crystallographic Association, American Astronomical Society, American Association of Physicists in Medicine, and American Vacuum Society. Particular attention is paid to the 1980 employment situation of society members, examining employer, work activity and subfield distributions, and analyzing variations in salary level in some detail The extent and nature of employment and salary changes between 1979 and 1980 are also outlined for those society members who responded in both years.

Data for this report were drawn from a small random sample of U. S. and Canadian members of the AIP member societies, originally surveyed in 1979 and queried again in 1980 The profile data refer only to individuals who were still members in 1980. Individuals who dropped society membership between 1979 and 1980 are discussed separately in Appendix C. The methodology, definitions, and limitations of this study along with copies of the questionnaire instruments used are presented in Appendices D, E, and F, respectively. It should be noted that data in this report refer only to individuals who were already members of one of the AIP member societies in 1979. Currently the sample is being expanded to bring in new society members and to better represent some of the smaller societies. Results of this expansion will be reflected in next year's profile.

The body of this report consists of text, illustrative figures, and a few basic tables. Detailed tables presenting more extensive data on the variables discussed here can be found immediately following the profile in Appendix A.

Background Data

The total membership of the nine AIP member societies reflects considerable diversity.[1] Physicists, astronomers, chemists, other scientists, and engineers are all represented with engineers being the second largest group after physicists. While the geographical distribution of society members is widespread, they are somewhat more heavily concentrated on the east and west coasts as illustrated in Fig. 1. In comparison to the total U. S. population they are more strongly represented in the Pacific, Mountain, New England, and Middle Atlantic regions and underrepresented in the Central states. It should also be noted that approximately 15% of the membership are foreign members living abroad; only those residing in Canada (nearly 3% of all society members) were contacted in this study.

Two-thirds of the society members hold Ph.D 's and they are relatively young, 40% having received their degrees since 1970. Few society members, on the other hand, are women or U. S. citizen minorities, 5% respectively.

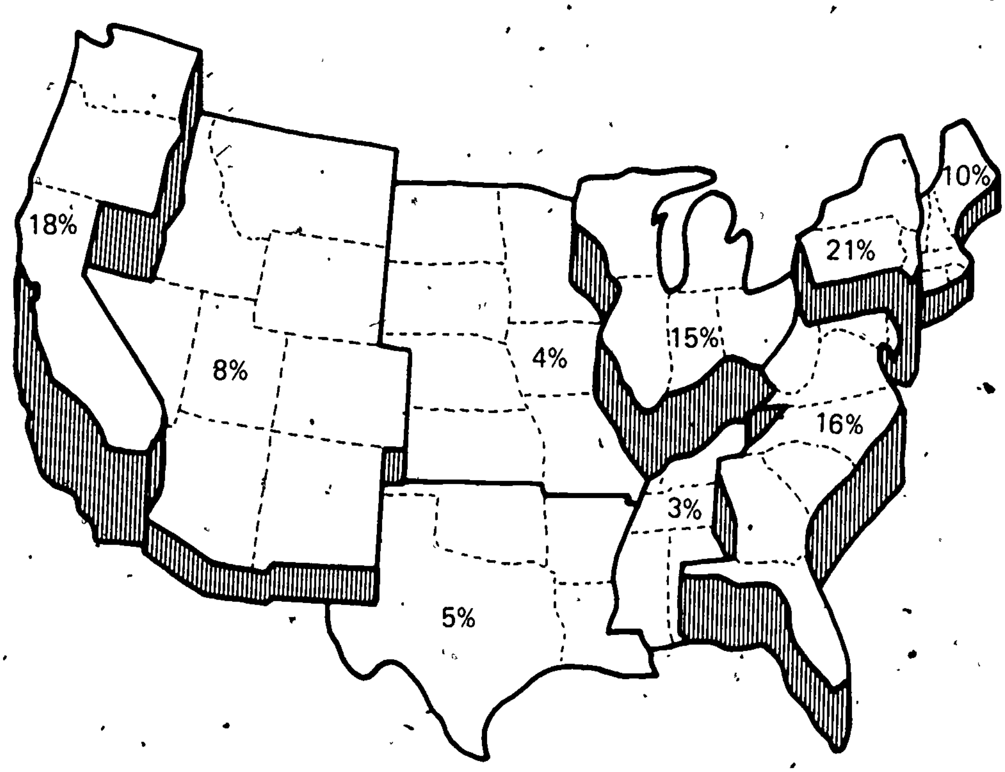

FIG. 1 Regional distribution of society members in the U.S., 1980.

*Special acknowledgment is given to Selma Malherbe for her valued assistance in the preparation and production of this report

[1]See "AIP Member Societies Entering the 1980's" (AIP Pub R-297, September 1980) the initial report on data from the 1979 survey, for a fuller discussion of this diversity

Employment 1980

Most society members are employed full-time, with the unemployment rate in 1980 falling below 1%.[1] Figures 2 and 3 show where respondents were employed and what they were doing in 1980. Over half of the society members were employed outside of academe with industry being the primary nonacademic employer, work activities were broadly diversified. These distributions are very similar to those observed in 1979 with a slight increase in industrial employment and applied research and a slight decline in university employment, basic research and teaching.

Those society members who are industrially employed are relatively concentrated, over one-third of them are located in 19 companies As illustrated in Fig. 4 these large companies each employ between one and five percent of the society members working in industry. The long tail on the curve reflects the large number of companies where only a few physicists were employed Although not as pronounced, university employment is also rather concentrated with one-fifth of the university physics faculty, for example, working at the 19 largest institutions When four-year colleges, with their smaller staffs, are included in the base there is more dispersion.

Type of employment reflected a variety of factors, several of them are summarized in Fig 5 Ph D's, older scientists, females, astronomers, and individuals involved in teaching and basic research are more likely to be employed in academe and less likely to be employed in nonacademic areas than Masters and Bachelors, younger scientists, males, engineers, and those involved in applied research, development, and design.

One of the striking aspects of Fig. 5 is the heavier involvement of the more recent Ph D.'s in nonacademic employment. Figure 6 explores this relationship in more depth A declining proportion of university employed Ph D 's can first be observed in the 1965–69 degree cohort, the decline continuing among the more recent degree recipients. Industrial employment on the other hand absorbs an increasingly larger proportion of the Ph D. cohorts from 1970 on Part of this pattern has been due to increasing industrial employment opportunities and lagging academic ones, the latter further diminished by the large proportion of tenured full and associate professors (nearly 85%) among the current faculty. As illustrated in Fig. 7, the large bulk of these associate and full professors are still a number of years from retirement limiting the opportunities for upward mobility of the new assistant professors.

Ironically, this lack of prospects for academic mobility coupled with increasingly high salaried industrial opportunities may have the effect of creating a shortage where but a few years ago there was an apparent oversupply Supporting evidence can be found in later sections on salary and mobility.

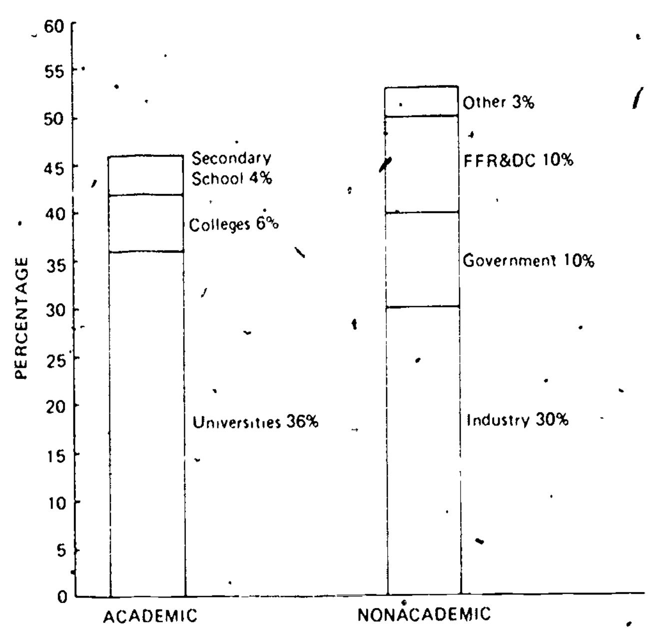

FIG 2. Type of employers, 1980.

Subfields

Society members worked in a wide variety of fields and subfields in 1980 Two-thirds of them were employed in Physics and Astronomy with Solid State Physics, Astronomy and Astrophysics, Physics Education, Optics, Nuclear Physics, Acoustics, and Plasma Physics being the largest Nearly 15% were employed in Engineering, particularly Electronic, Electrical, and Systems Engineering, another 15% were employed in other sciences particularly Chemistry, Computer Science, and Materials Science. Finally a small proportion, 5%, were employed in nonscience activities with major emphasis on Educational and General Administration.

Since Ph.D.'s and advanced graduate students make up three-quarters of the society members, they also predominate in most subfields, particularly in such subfields as Elementary Particles, Astronomy, Astrophysics, and Nuclear Physics. Nonstudent masters and bachelors degree holders are more likely to be found in Physics Education, Acoustics, Optics, Engineering, and Computer Science.

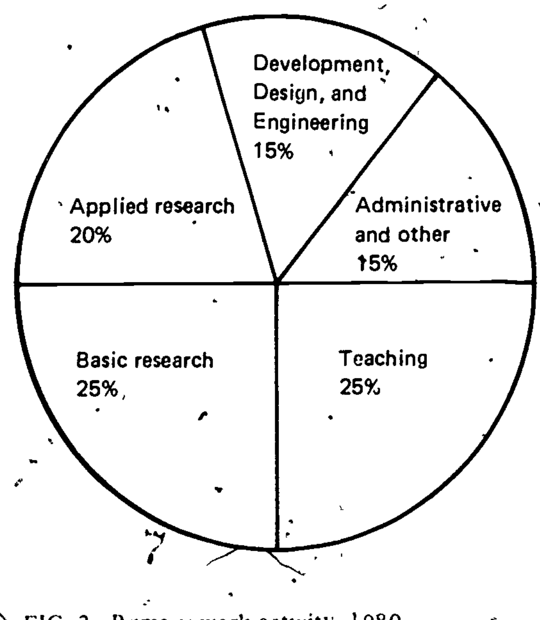

FIG. 3. Primary work activity, 1980.

[1]The unemployment rate is the number of individuals unemployed seeking employment divided by the labor force The figure in 1980 was 0 9%

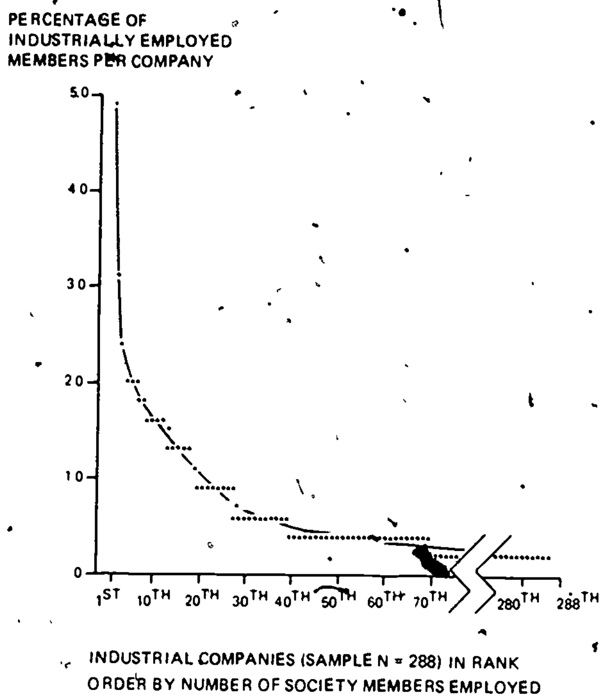

FIG. 4. Distribution of industrially employed members by company, 1980.

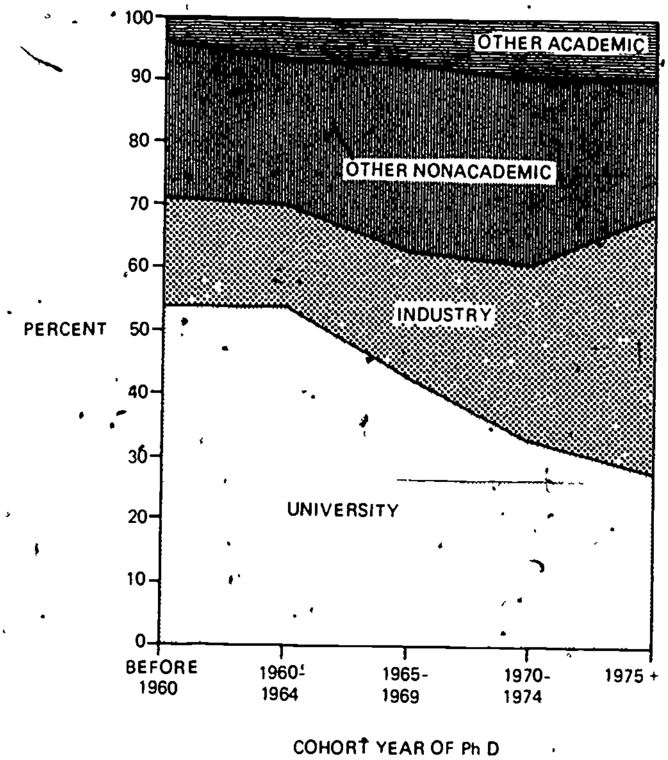

FIG. 6. Type of employer by cohort year of Ph.D.

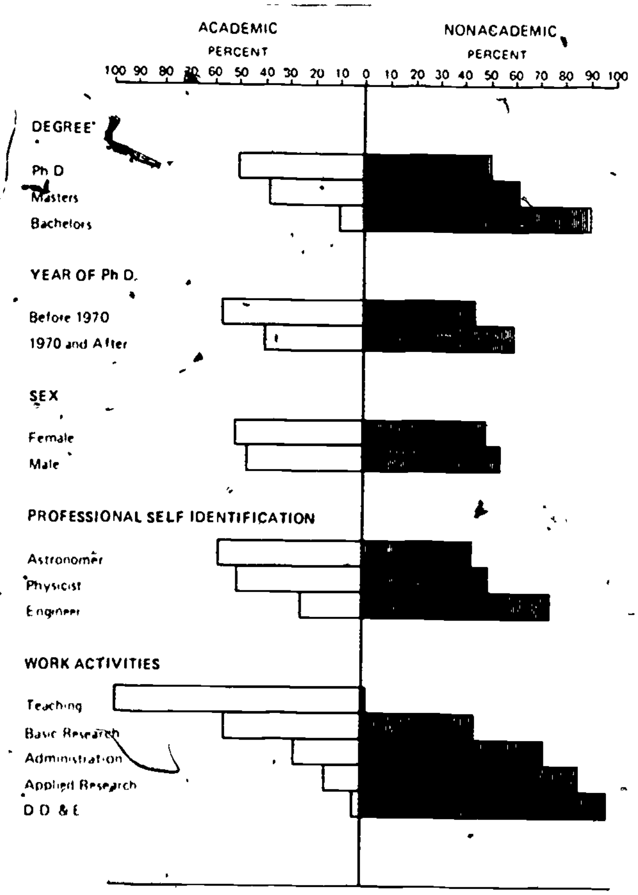

FIG. 5. Type of employer by selected variables, 1980.

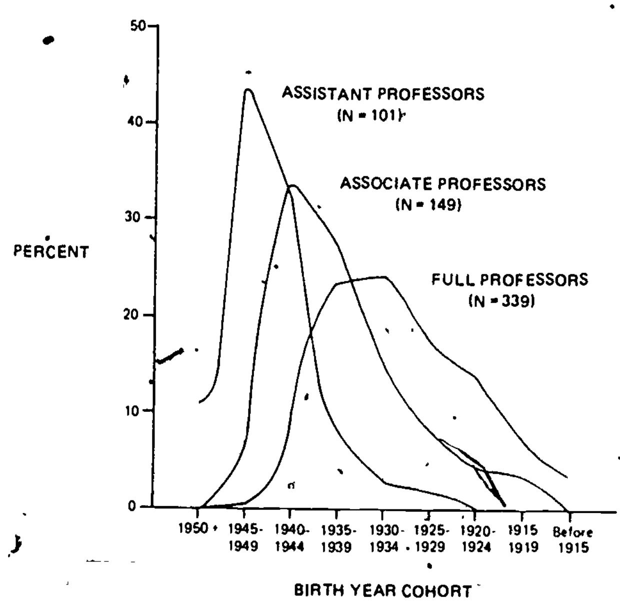

FIG. 7. Age profile by professional rank includes fulltime employed only, 1980.

TABLE 1. Professional self-identification of society members in selected subfields of work, 1980

PROFESSIONAL SELF-IDENTIFICATION

	Primarily Physicist[a]	Primarily Engineer[a]	Primarily Other Scientist[b]
Subfields of Work:	Elementary Particles	Chemical Engineering	Chemistry
	Nuclear Physics	Mechanical Engineering	Psychology
	Plasma Physics	Electrical Engineering	Astronomy
	Physics Education, College		
	Solid State Physics		
	Atomic and Molecular Physics		
	Medical Physics		

	Physicist and Engineer[c]	% Physicist	% Engineer	Physicist and Other Scientists[c]	% Physicist	% Other Scientist	
Subfields of Work:	Optics	70	30	Astrophysics	50	50	Astronomer
	Fluid Dynamics	60	30	Computer Science	50	50	varied
	Acoustics	45	40	Earth and Environmental	50	50	varied
	Systems Engineering	45	50	Materials Science	40	60	Chemist, Engineer
	Aeronautical and Astronautical	40	50	Mathematics and Statistics	40	60	Mathematician
	General Engineering	40	60	Chemical Physics	30	70	Chemist
	Electronic Engineering	30	70				

[a]83% or more of society members working in these areas identify themselves as physicists and engineers, respectively

[b]84% or more of the society members working in these areas identify themselves with the indicated field.

[c]Figures are rounded to the nearest 5% They will not always total 100%, since other minor self-identification may be present

Not unexpectedly in societies affiliated with the American Institute of Physics many of the largest employment subfields consist primarily of members who identify themselves as physicists. Elementary Particles, Nuclear Physics, Plasmas, Physics Education, Solid State Physics, Atomic and Molecular Physics, and Medical Physics providing the clearest examples. However, this is not the case in all areas. As Table 1 illustrates, in several fields and subfields one can find working a mixture of society members with varying professional self-identifications. Engineers and physicists are both heavily involved in areas such as Optics, Fluid Dynamics, Acoustics, Systems, Aeronautical and Astronautical, Electronic and General Engineering. Chemists and physicists are heavily involved in Materials Science and Chemical Physics, while an equal number of astronomers and physicists can be found working in Astrophysics. In contrast there are some areas of work where few society members identified themselves as physicists. Mechanical, Chemical, and Electrical Engineering, Astronomy (in marked contrast to the situation in Astrophysics), Chemistry, and Psychology.

Professional self-identification reflects a variety of factors, field of degree and field of work both playing a major part Figure 8 illustrates this relationship for society members with degrees in the two largest fields: Physics and Engineering. Not unexpectedly where field of degree and work are the same, professional self-identification is quite predictable. Of

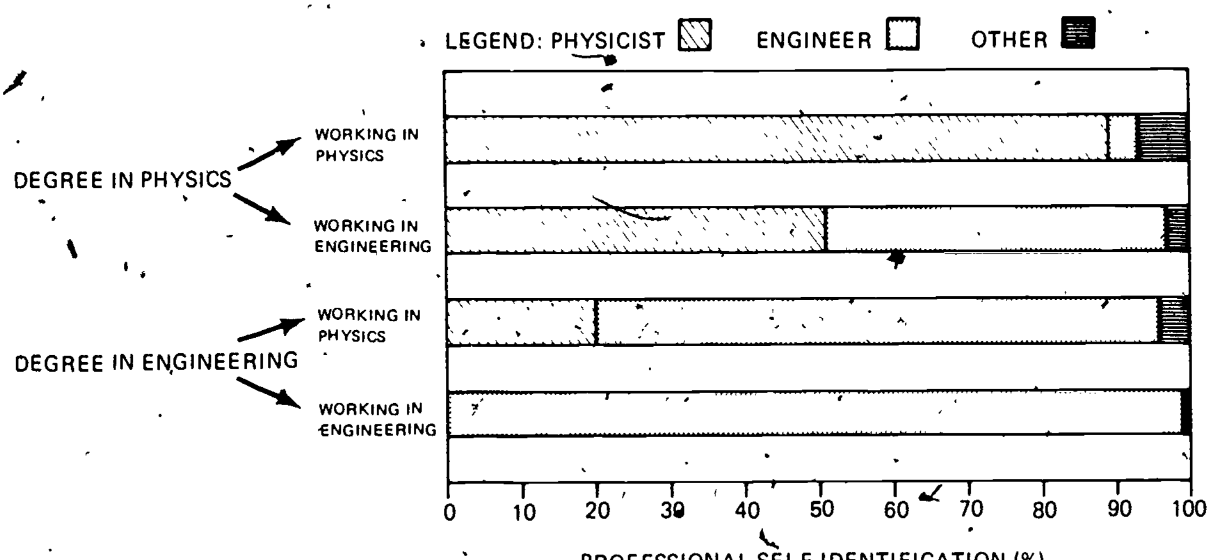

FIG. 8. Professional self-identification by selected degree and work fields.

TABLE 2 Major subfields of decline and growth between degree and current work, 1980

Selected subfields	Percent change Degree/Work	Degree N.	Work N.
Decline			
Nuclear Physics	− 64	183	66
Low Temperature Physics	− 60	47	19
Elementary Particles and Fields	− 48	134	70
Atomic and Molecular Physics	− 45	94	52
Solid State Physics	− 41	207	122
Growth			
Medical Physics	+ 163	19	50
Optics	+ 104	47	96
Acoustics	+ 91	33	63
Geophysics	+ 64	11	18

more interest, perhaps, is what happens when degree and work fields diverge. Half of the physics degree holders now working in Engineering still consider themselves physicists, nearly half consider themselves engineers. Engineering degree holders now working in Physics, on the other hand, are more likely to retain their identification as engineers, only one-fifth consider themselves physicists. Little is known about when these changes in professional identification occur and what impact they may have on ensuing careers.

As the foregoing discussion suggests, scientific subfields of work are not rigidly structured. There is a frequent flux of individuals between fields and subfields. A degree, either bachelors, masters, or Ph.D., in a given field or subfield does not mean that an individual will necessarily continue to work in that area. In fact among society members who are physicists and astronomers only 40% are still working in the same subfield they were trained in, 35% have moved to another physics or astronomy subfield while 25% have moved out, usually into other fields of science and engineering. A substantial amount of change then can occur between degree and work. Nuclear Physics, Elementary Particle Physics, Atomic and Molecular Physics, and Solid State Physics are among the largest subfields of physics degree production; they are also, as Table 2 indicates, fields which have experienced major net declines between degree and work. Medical Physics, Optics, Acoustics, and Geophysics on the other hand have all shown patterns of substantial growth.

Although the current sample is too small to explore the intricate patterns of subfield mobility in depth, Fig. 9 presents a general picture of the movement of individuals who were trained in but departed from the four major fields of Solid State Physics, Nuclear Physics, Elementary Particle Physics, and Atomic and Molecular Physics. Some of this mobility was between the major fields as evidenced by the movement into Solid State Physics from Atomic and Molecular Physics and the exchange relationship between Nuclear and Elementary Particle Physics. However most of the mobility was into such small, but growing physics subfields as Optics and Medical Physics and into the related science and engineering areas of Electronic and Nuclear Engineering, Materials Science, and Computer Science. Continued monitoring of these patterns of field mobility are necessary for a full understanding of the changing utilization of scientific and technical manpower.

Salaries

In a period of inflation and growing demand for physical scientists and engineers, current information on salary levels

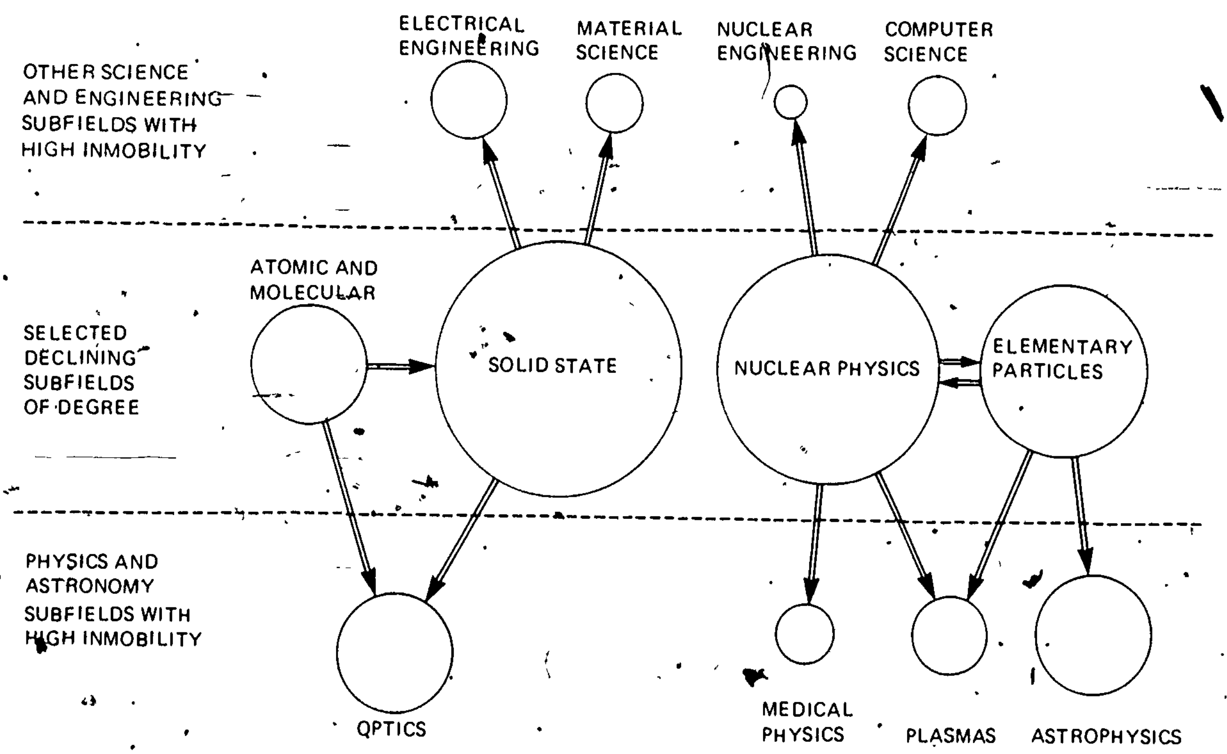

FIG. 9 Major subfield destinations of society members leaving Atomic and Molecular, Solid State, Nuclear and Elementary Particle Physics, 1980.

TABLE 3. 1980 industrial* salaries by level of highest degree.

	Median salary (in thousands of dollars)	Median age	Total number known
Ph D	36 0	38.7	315
Masters	33.0	43 5	107
Bachelors	35 0	50 8	83

*Includes self-employed

in the different sectors of the economy has been more frequently requested. Such salary information is particularly sought by individual scientists wishing to evaluate their positons; and employers wanting to be competitive in the labor market. The expanded presentation in the body of this report and the detailed data in Appendix A should help to accomodate such concerns.

The median salary in 1980 for society members was $32 000, approximately $4 000 higher than it was the previous year [1] Those employed in secondary schools and junior colleges had the lowest median salaries, about $22 000, while those members employed in industry and government had the highest, $35 000 and $36 000 respectively.

In industry society members at all degree levels worked in sufficient number that some comparisons of salary can be made. As Table 3 illustrates the median salary of Ph.D.'s is the highest at $36 000. While bachelors degree holders earn almost as much as the Ph.D.'s, it should be noted that they are, on the average, 12 years older. Masters degree holders, who are about 5 years older than the Ph.D.'s earn approximately $3 000 less. Comparisons between degree levels in other employer areas is difficult since outside of industry there are relatively few nonstudent lower degree holders among the society members.[2]

As Fig. 10 indicates there is some variability in salary by geographic region with those Ph.D.'s employed in the western and middle Atlantic states earning the highest salaries and those employed in the central states earning the lowest.

TABLE 4 1980 salaries by principal work activity, Ph D 's.

Principal work activity	Median salary (in thousands of dollars)	Median age	Total known responses
Teaching	27 0	44 7	351
Basic research	31.5	41 0	393
Applied research	35 0	38 8	291
D , D., &E *	35 9	39.2	115
Administration	43.0	47 1	113
Other	35 0	39.8	40

*Design, Development, and Engineering.

[1]In most of this discussion we will be referring to median salaries The detailed tables in Appendix A however present both the median and mean salaries, the difference between them reflecting the skewness in the distribution.

[2]Masters degree holders do predominate in secondary school teaching at a median salary of $21 900. However there are too few Ph D 's or bachelors in our sample working in this area to present any comparisons

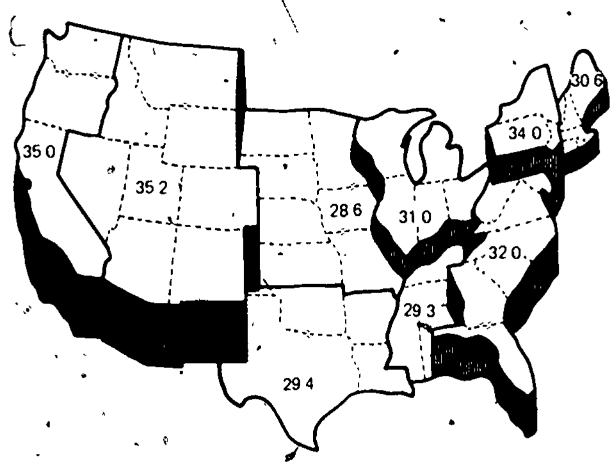

FIG. 10. 1980 median salary by geographic region.

It may be noted that those regions with the lowest median salaries are also those with the lowest concentration of society members. Salaries also vary by work activity, ranging from $27 000 for those Ph.D.'s primarily engaged in teaching to $43 000 for those primarily engaged in administration. As Table 4 outlines, both of these groups of Ph.D.'s are older than those involved in research and development whose salaries range from the low to mid $30 000's.

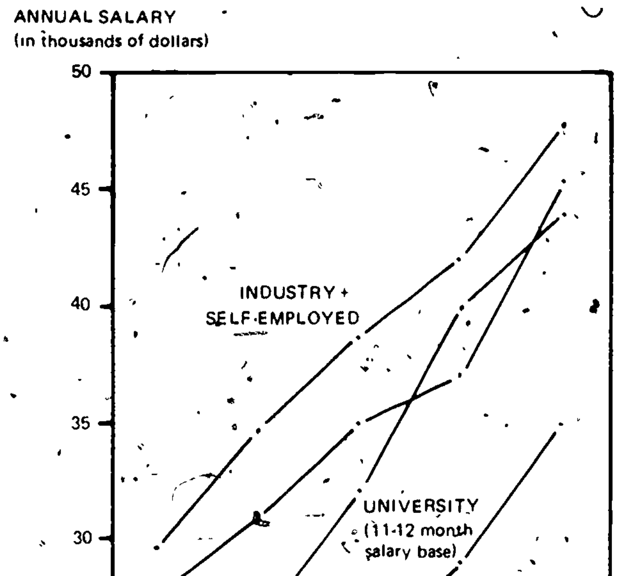

FIG. 11. 1980 median salaries by selected employer type and years from Ph.D., excluding postdocs.

11

Variability in salary by type of employer can perhaps best be explored by looking at the different experience curves. Figure 11 compares the median salaries of individuals employed in universities, both on 9–10 month and 11–12 month salary bases, to those employed in industry and in government and national laboratories.[1] The two university groups start at approximately the same salary level, but diverge as years from degree increase. The difference between 9–10 month university salaries and industrial salaries is major both for starting and more experienced Ph.D.'s with the greatest disparity occurring among those 10–14 years beyond the Ph.D.

Since there is variation in salaries not only between but within employer types Figs. 12–16 present the median salaries, the salaries above the median at the seventy-fifth percentile, and the salaries below the median at the twenty-fifth percentile in five major employment areas by years since the Ph D [1]

Industrial salaries, usually higher than those in other areas also show the greatest variability, particularly as years from degree increase. This reflects both the diversity in companies for which society members work and the quite different career paths open in industry The upper right-hand section of the curve in Fig. 12 primarily represents scientists and engineers who have moved into general administration or who have started their own companies. Individuals remaining in corporate research, development, and engineering typically have salaries falling at or below the median levels In marked contrast are the government salaries. Although the median salaries in government are nearly as high as industrial salaries, the variability is considerably less, especially for those who are 15 years and more beyond the degree. Part of this, at least, is due to the ceiling on federal salaries. (Whether this will have the effect of encouraging mobility out of top level government positions can not yet be determined with our small sample.) The salaries in the Federally Funded Research and Development Centers are somewhat below those in the other nonacademic areas, probably reflecting the high proportion of individuals involved in basic research in this sector. Their median salaries

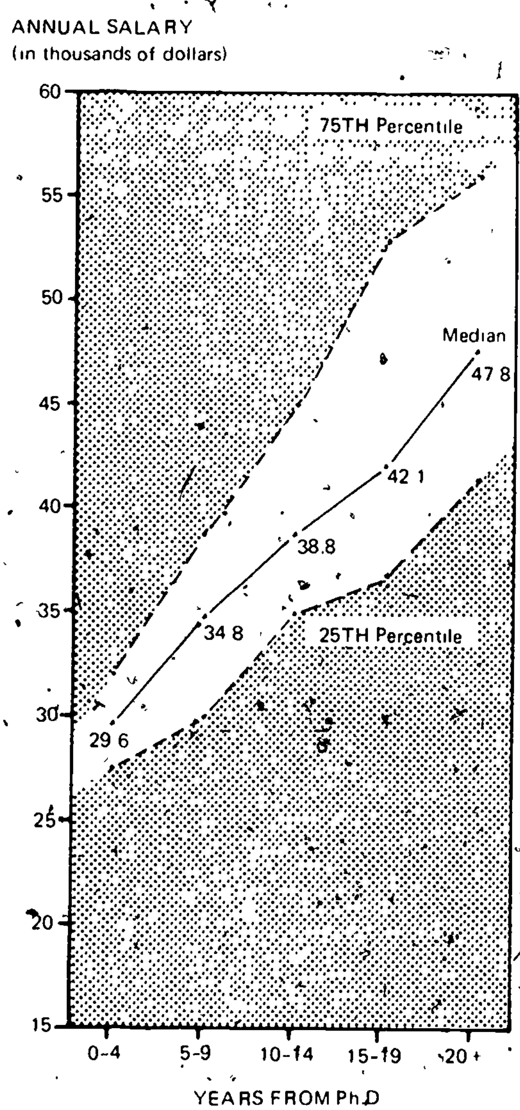

FIG 12. 1980 median salaries by years from degree for industry employed Ph.D 's.

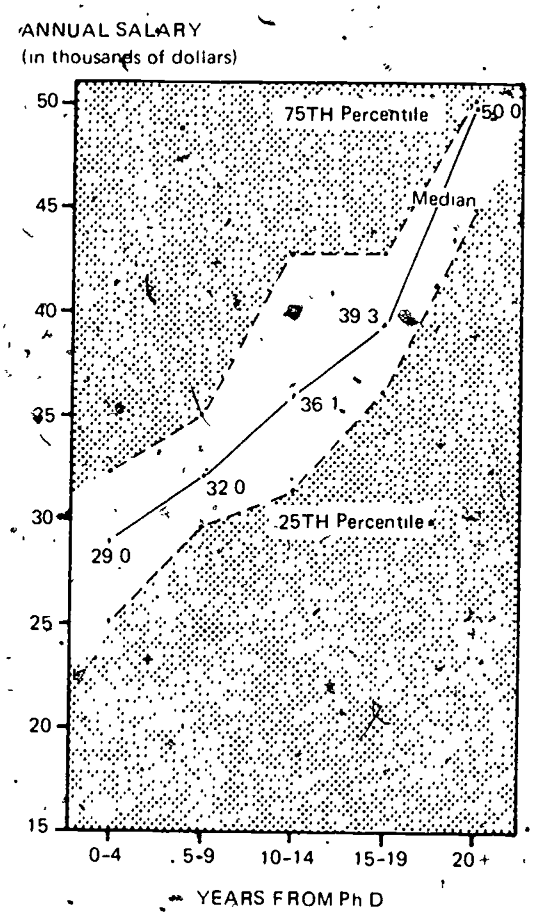

FIG 13 1980 median salaries by years from degree for government employed in Ph.D.'s

[1] Ph D's holding postdoctoral positions are not included in this comparison They are usually employed at universities on an 11–12 month salary base, and in our sample had an average salary in 1980 of $14 400

[1] Minor irregularities in the curves should not be given too much significance since they may partly be artifacts of small sample size See Appendices D and E for methodological notes and definitions of median, percentiles, and other statistical measures used in this report

track the lower twenty-fifth percentile of industrial salaries quite closely.

Academic salaries, on the traditional 9–10 month salary base, are considerably lower than the nonacademic ones at all levels. The slopes of the salary curves indicate only a gradual increase in salary with years of experience and the variation in salary for most year of degree cohorts is relatively narrow The salaries of those on an 11–12 month salary base are quite different in terms of levels, slopes of the curves, and variation. This may be a reflection of the diverse composition of the group which includes, in addition to some teaching faculty, a number of individuals in long-term research staff and administrative positions. Full detail for these and other salary distributions of interest may be found in Appendix A.

The relation of comparative salary levels to mobility in and out of different employment sectors are discussed in the following section.

Employment 1979–1980

The majority of members (80%) who responded to the 1980 survey had also responded in 1979. This sizable sample permits a longitudinal analysis of major, work related changes Twenty percent of the society members who replied in both years made one or more employment related changes. Predominant was the change in employers. (See Table 5.) Approximately three-quarters of those who changed employers also changed type of employer. These changes usually involved moves by younger members into industrial employment from universities, colleges, and fed-

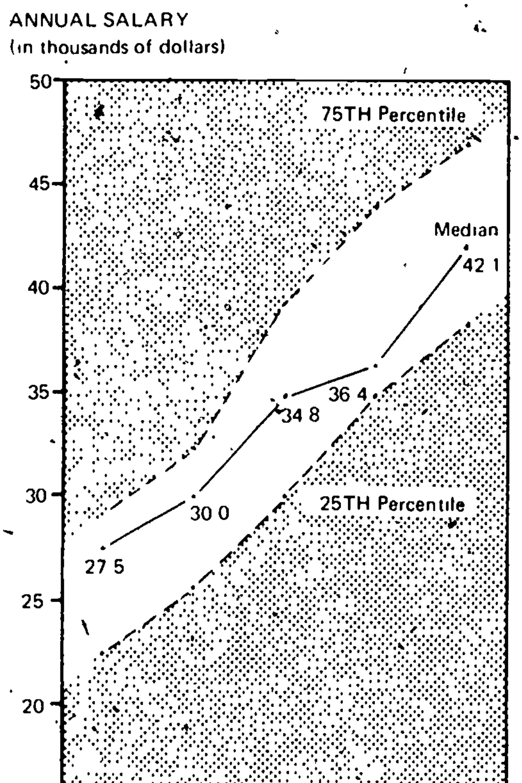

FIG. 14 1980 median salaries by years from degree for R&DC employed Ph D 's.

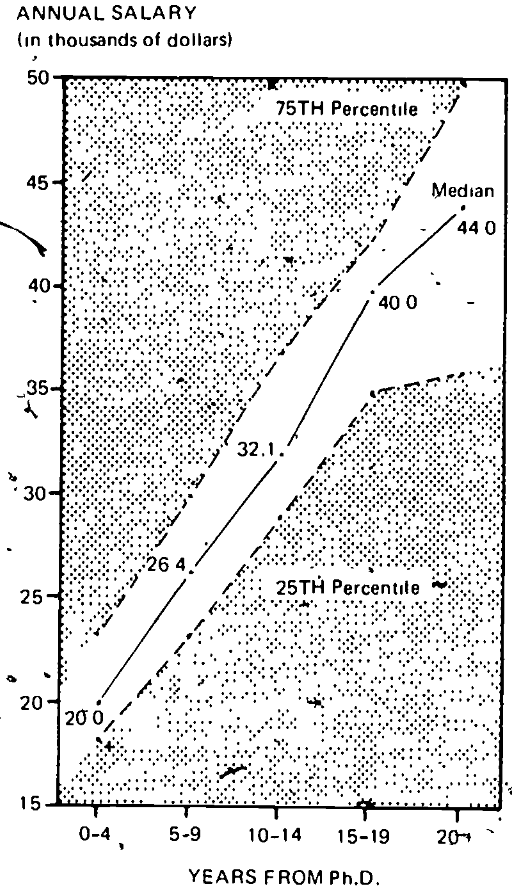

FIG 15 1980 median salaries by years from degree for university employed Ph D 's, 11–12 month salary base, postdocs excluded.

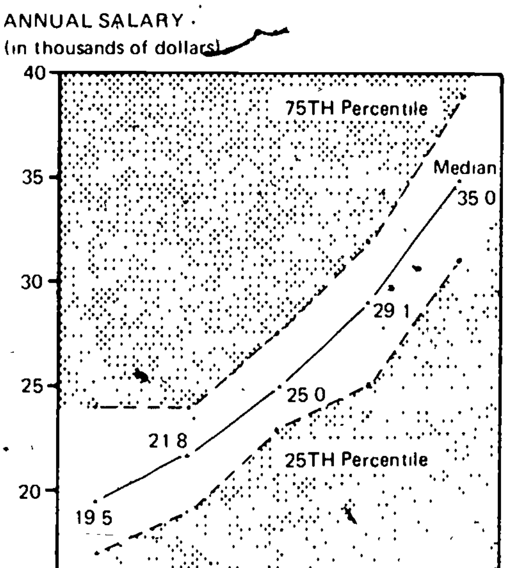

FIG 16 1980 median salaries by years from degree for university employed Ph.D 's, 9–10 month salary base, postdocs excluded

TABLE 5 Employment-related changes, 1979–1980.

	Percent reporting change[a]
Employer name	11
Primary work activity	9
Type of employer	8
Primary subfield of work	6
Academic rank	6
Employment status	4
Tenure status	3
Highest degree	3
Professional self-identification	2
Total known response	**1667**

[a]Percentages are based on the society members who responded in both 1979 and 1980.

eral laboratories. More than half of those who were employed in academe in 1979 and who changed employers moved into industry But the reverse was only half as likely. Only one-quarter of those who were employed in industry in 1979 and who changed employers moved into academe. The moves from academe into industry frequently entailed a shift in work activity from basic research and teaching to applied research, development, design, and engineering.

Changing jobs often involved changing geographic locations and long distance, career related moves were common. Forty percent of the members who changed employers moved to another region of the country.[1] The prevalence of interregion mobility differed by region of residence in 1979. The proportion of members who left their region of residence when changing employers was highest in the East South Central and South Atlantic areas (80% and 65% respectively) In contrast, only 20% of the members changing jobs in the Pacific region left that area.

The majority of interregional moves were to the adjoining geographic regions. However, two longer distance migration patterns appear to be emerging in this one-year follow-up of our sample. Most of the employed members who left the heavily industrialized East North Central moved to either the Pacific or the South Atlantic regions, while most of those who left the South Atlantic moved to either the Mountain or the Pacific regions.

The general migration trend was toward the west. As shown in Table 6 the highest outmobility of society members occurred from the South East. Conversely, the Mountain region and the Mid West experienced the highest inmobility of society members.

Field and subfield change was, in one year, not as noted as employer change. Movement out of physics and astronomy during this brief period was minor, although small increases in engineering and computer science employment could be observed. More prominent, although still at a low level, was subfield mobility within physics. It will be several years before definite patterns can emerge, but in this first year of comparative statistics, there was an increase in the number of society members in Geophysics, Optics, and Electronics.

Salary Increases 1979–1980

The data for salary increases presented in Fig. 17 are based on those members who did not change employers between 1979 and 1980. These salaries more accurately reflect actual annual increases. Most members who changed employers also changed type of employer and their salaries are greatly influenced by the substantial differences in salaries between types of employers. The latter will be discussed in more detail later in this section.

Overall nonacademic salaries increased by a larger amount than academic salaries during 1979. Nonacademic salaries increased by approximately $4 000 with somewhat higher increases for those employed in industry. Academic and government salaries increased by approximately $3 000. The lower increase in government salaries is due, in large part, to the high proportion of society members who earn the current ceiling on federal salaries and so received little or no increase.

Salary is dependent upon work activity as well as employer type. Members who continued in the same work activity between 1979 and 1980 received salary raises ranging, on the average, from $3 000 to $5 000. The lowest increments were received by those engaged in teaching and administration. The highest were received by members in applied research. The latter, well-paid work activity area is growing and attracting an increasing number of the younger society members.

Less than 5% of employed society members are women and so there are too few women in the longitudinal sample for a highly detailed analysis of salaries. However, the sample is large enough to permit several general comparisons between the salaries of men and women who did not change employers. Academically and nonacademically employed women earned less than their male colleagues in both 1979 and 1980. Salary increases for nonacademically employed women kept pace with those received by men but women in academe seem to have received smaller increments than men. There are three reasons for the discrepancy in academic salares: age/experience, place of employment, and type of employment. The women employed in academe are somewhat younger and thus, presumably, have less experience than men. Women are less likely to be employed in colleges and more likely to be employed in secondary schools, which pay lower salaries. A related reason for the salary differences appears to be the type of academic posi-

TABLE 6. Regional mobility of employed members, 1979–1980.

Region[a]	Employed society members, 1979 N	Regional outmobility[b] %	Regional inmobility[c] %
New England	141	4	5
Middle Atlantic	275	4	2
South East	286	6	4
East North Central	222	4	3
Mid West	144	3	8
Mountain	117	5	12
Pacific	332	2	3
Total Number Known	**1517**		

[a]The South East refers to the East South Central and the South Atlantic. The Mid West refers to the West North Central and West South Central.
[b]Percentages are based on the number leaving between 1979 & 1980 compared to the number who resided there in 1979
[c]Percentages are based on the number entering between 1979 & 1980 compared to the number who remained there from 1979 to 1980

[1]See Appendix B for description of regions by states

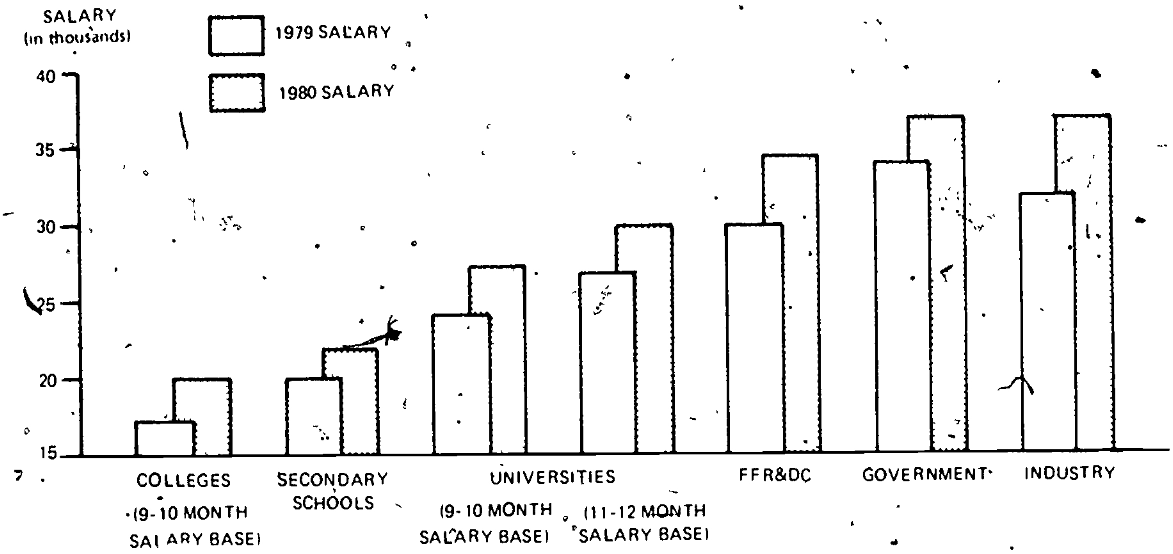

FIG. 17. 1979 and 1980 median salaries by employer type

tions held by women. Half of the women, but only one-quarter of the men, who are employed in colleges and universities hold lower paying, nontenure line positions such as: research associate, instructor, and lecturer. It should be noted that given the small sample size, these women may not be representative of all female society members. However, this pattern will be closely monitored in our 1981 survey which was expanded to include more than twice the number of society members queried in 1980. This expanded sample will provide a more accurate picture of the salaries earned by women.

Employment and Salary Change 1979–1980

Society members who change employers or employer type tend to be younger; thus their 1979 and 1980 salaries are below the median for their respective employer type. This; however, does not diminish the fact that those who moved from university to industry (the most common employer type change) were rewarded with singularly large salary gains ($12 000 on the average). Members who changed industrial employers received increments comparable to the increase received by members continuing with the same industrial employer. While members changing university employment appear to have received increases larger than members remaining with the same university, this is partly an artifact of their moving from lower paying postdoctoral positions into better paying assistant professor positions. Other employer type changes occurred too infrequently within our sample to allow salary analysis.

Although the second most commonly reported changes were in primary work activity, these changes were too diffuse for detailed analysis. For this reason, work activities were combined into two broader areas: the more traditional work activities (teaching and basic research) and all the remaining work activities, i.e., applied research, development, design, and engineering. Mobility from the more traditional areas into the other work activities was reported twice as often as the reverse shift; was made by younger members receiving relatively low salaries in 1979; and was rewarded substantial salary increases. It should be noted that the salary structure by work activity closely resembles the salary structure by employer type reflecting the considerable overlap between employer type and work activity.

It is difficult to predict the long-term effects of the mobility patterns in both current employer type and work activity observed during 1979. Industry is attracting increasing numbers of recent Ph.D.'s with high salaries and good opportunities for advancement. It appears likely that, as industry and government continue to increase the funds allocated for applied research, fewer young Ph.D.'s will be drawn to the more traditional areas of basic research in academe.

This report has examined scientific employment and change based on information gathered during 1979 and 1980. Data collected from the 1981 membership survey will provide yet another point of reference. Therefore, the report based on the data, to be published next year, will further elucidate the long-term patterns of scientific career development.

Society Membership Profile

While the nine AIP member societies are similar in their commitment to furthering the advance of science and technology, both in physics and related disciplines, they each also exhibit special characteristics of their own. In last year's report we examined the broad diversity of society membership; next year with an expanded sample, we will be able to look at each of the societies in greater detail.[1] In the current interim report, brief profiles of the characteristics of the members of each of the nine societies will be presented.

Although each of the societies is a separate entity, it should be noted that there is some overlap in membership between the societies. As Table 7 illustrates, the extent of this multiple membership varies by society. Over one-third of the members of the American Association of Physics Teachers (AAPT) and one-quarter of the members of the Optical Society of America (OSA) belong to one or more other AIP member societies, primarily The American Physical Society

[1]The 1981 sample survey was expanded in size and stratification to include new members and a larger proportion of the members of the smaller societies

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TABLE 7. Society cross membership, 1980[a]

	APS %	AAPT %	OSA %	ASA %	AVS %	AAS %	AAPM %	ACA %	SoR %
APS	**77**[b]	32	20	7	20	18	15	14	14
AAPT	10	**61**	5	3	2	5	4	—	—
OSA	5	4	**72**	3	4	5	—	—	—
ASA	1	2	2	**90**	—	—	—	—	—
AVS	3	1	2	—	**76**	—	—	—	—
AAS	2	2	2	—	—	**75**	—	—	—
AAPM	1	1	—	—	—	—	**80**	—	—
ACA	1	—	—	—	—	—	—	**84**	—
SoR	—	—	—	—	—	—	—	—	**84**
Total Membership	27 822	8630	7008	4726	3606	3355	1701	1408	935

[a]Data are based on all members current in 1980 and residing in the U S or Canada.
[b]Diagonal percentages (in bold) represent single society membership.
[c]Dashes represent less than 1% of the society's membership Each column will not sum to 100% because 2% of all members belong to three or more societies and so are counted more than once

(APS) On the other hand, members of the Acoustical Society of America (ASA), The Society of Rheology (SoR), and the American Crystallographic Association (ACA) are more likely to belong to their parent society only.[1] Further reports will explore these patterns of single and multiple membership and related membership characteristics in more detail.

Prominent characteristics of the different society memberships are summarized in Table 8. The following paragraphs present brief profiles of each of the nine societies.

The American Physical Society (APS), the largest of the AIP member-societies, had over thirty thousand members in 1980 Reflecting the broad range of interests to be found in the society, members of APS also belonged to each of the other eight societies. A very high proportion of APS members, over 80%, hold Ph.D.'s, three-quarters consider themselves physicists, and nearly half are employed in academe. These academic members of APS are predominantly tenured university full and associate professors. Nonacademic representation, however, is also strong in APS with one-quarter of the members employed by industry and one-quarter by the government and national laboratories. The largest research subfields for APS members are Solid State Physics, Nuclear Physics, Plasma Physics, and Elementary Particle Physics.

[1]Members of these societies may, however, also hold membership in other, non-AIP, science, and engineering societies Such multiple membership has not yet been examined

The American Association of Physics Teachers (AAPT) with its concern for the quality of physics teaching at all levels is heavily based in academe. Most striking is the varied teaching involvement of AAPT members; one-third of the members teach at universities, more than one-fifth at the four-year and two-year colleges, and nearly one-fifth in the nation's secondary schools. Only a few secondary school and two-year college teachers belong to any of the other AIP member societies. Reflecting the tight academic market, the AAPT membership has declined during the past decade; between 1979 and 1980 it had one of the lowest proportions of new members among the societies, although it still remains the second largest society. While one year is too brief a period to really explore mobility, some mobility out of academic institutions at all levels and into industrial employment could be observed among AAPT members.

The American Astronomical Society (AAS), composed primarily of astronomers and physicists, has a higher proportion of Ph.D.'s among its members, 82%, than any of the

TABLE 8 Prominent characteristics of society members, 1980

Society	Median age	Prof. self-identification	Major employers	Primary work activity
AAPM	39.6	Physicist	Univ , Hosp	Nuclear Medicine, Applied Research
AAPT	43 7	Physicist	Univ , Coll , Sec Sch	Teaching
AAS	39 7	Astron., Phys	University	Basic Research, Teaching
ACA	45 5	Chem , Phys	Univ , Ind , Govt	Basic/Applied Research,
APS	43 1	Physicist	Univ , Ind	Basic/Applied Research, Teaching
ASA	43 0	Eng , Phys	Ind , Univ	Applied Research, Teaching, Design/Engineering
AVS	43 5	Phys , Eng.	Industry	Development, Administration, Applied Research
OSA	42.2	Phys , Eng.	Ind , Univ	Applied/Basic Research
SoR	44 0	Engineer	Ind , Univ	Applied/Basic Research, Teaching

other societies. Its membership is also one of the youngest and is heavily involved in basic research. About half of the AAS members are academically employed, primarily in the universities with a relatively high proportion, one-third, of this academic group holding research associate and other nontenure line positions. In addition to academic employment a substantial number of AAS members are employed in government, and national observatories and the aerospace industry. While members work in a variety of areas, over 70% are primarily involved in astronomy and astrophysics.

The American Crystallographic Association (ACA), one of the smaller but most international of the member societies, has more than 15% of its members living abroad. The society has remained relatively stable in size over the decade with a low proportion of new members entering between 1979 and 1980. Like the previously discussed societies a substantial proportion of its members are academically employed. ACA members, however, are older and are most likely to identify themselves as chemists, secondarily as physicists; their major fields and subfields of work are Crystallography, Chemistry, and Materials Science.

The American Association of Physicists in Medicine (AAPM), although still one of the smaller member societies, has grown dramatically over the past decade. This society, ninety percent of whose members identify themselves as physicists, remains the youngest among the societies. While more than half of AAPM members are academically employed, some with joint appointments at university affiliated hospitals, many are also employed outside of academe in hospitals, nonprofit research centers, and private group practices. While AAPM members are heavily involved in applied research, other work activities such as radiology, dosimetry, and varied aspects of patient care are predominant. Medical Physics, as expected, is the major subfield of current work for AAPM members; most of these individuals were trained in other areas moving into Medical Physics sometime after earning their degree.

The American Vacuum Society (AVS), the most industrially based of all AIP member societies, has also recently become the fastest growing. New members, joining between 1979 and 1980, represented nearly one-fifth of the total membership. Engineers and physicists joined by chemists provide a diversified membership working in Vacuum Science, Materials Science, Solid State Physics, and Electronic Engineering. Applied research, development, and administration have been the primary work activities in this society where Ph.D.'s, Masters, and Bachelors degree holders are all strongly represented. Varied changes are expected in this rapidly growing society.

The Optical Society of America (OSA), is the third largest of the AIP member societies, and, if its current steady rate of growth continues, may soon be the second largest; more than 10% of its members joined between 1979 and 1980. A relatively high proportion of OSA members live abroad, over 15%. The physicists and engineers who predominate among the membership are primarily employed in industry and university departments with a substantial proportion also to be found in government laboratories. They are heavily involved in applied research and development both in Optics and a broad variety of other physics and engineering subfields.

The Acoustical Society of America (ASA), has a membership drawn from diverse backgrounds in Engineering, Physics, Psychology, and related scientific disciplines. A high proportion, about 15%, of its membership joined between 1979 and 1980. Although the overall median age of ASA members remains rather high, the Ph.D. component, representing about one half of ASA members, is the second youngest among the societies. In the university, industry, and government, these members are quite heavily involved in applied research, design, and engineering. Although Acoustics is the primary subfield of work, members are involved in a broad variety of science and engineering areas.

The Society of Rheology (SoR), the smallest of the AIP member societies, has shown a surge in growth in the past few years; a high percentage, over 15%, of its membership was new, joining between 1979 and 1980. SoR members primarily identify themselves as engineers; chemists, physicists, and related scientists make up the remainder of the membership. Working primarily in Rheology and Chemical Engineering, members find major employment in industry; however, considerable academic involvement was also observed. Next year's report on the expanded 1981 sample should provide greater detail on this small society.

These brief descriptions of the nine AIP member societies and their varied membership are but thumbnail sketches of the rich diversity to be found within the societies. The expanded 1981 sample, which includes a sample of the new society members frequently referred to in the foregoing descriptions, should provide us with the opportunity to explore the changing composition of these societies in greater depth

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APPENDIX A: Detailed Statistical Tables.

TABLE A-1. Professional self-identification, 1980.

	%
Physicist	59
Engineer	16
Chemist	9
Astronomer	5
Other scientist	7
Other	4
Total number known	2075
No response	1

TABLE A-2 Regional distribution of society members in the U.S 1980 and total U S. population [a]

Region	Society Members %	U. S Population %
New England	10	6
Middle Atlantic	21	17
South Atlantic	16	16
East North Central	15	19
East South Central	3	6
West North Central	4	8
West South Central	5	10
Mountain	8	5
Pacific	18	14
Total known	2048[b]	220 Million

[a]Based on 1979 provisional population estimates.
[b]In addition there were 27 Canadians in the sample

TABLE A-3. Age profile of society members, 1980.

Year of Birth	%
1950 +	11
1940–1949	32
1930–1939	28
1920–1929	19
Before 1910	11
Total number known	2074
No response	2

TABLE A-4. Level of highest degree by years since highest degree, 1980

Year of Highest degree	Level of highest degree Ph.D. %	Masters[a] %	Bachelors[a] %
Before 1960	26	38	64
1960–1969	34	31	23
1970 +	40	31	13
Total Number Known[b]	1473	313	145

[a]There are 110 advanced graduate students not included in this table
[b]Five Ph D 's and three Masters did not indicate the year of their degree

TABLE A-5. Race and minority status by citizenship, 1980

Race and Minority Status	Citizenship U S. N.	Non-U S. N.	Total	%
White	1732	107	1839	92.3
Oriental and Other Asian	59	55	114	5.7
Black, American Indian, and Hispanic	24	2	26	1.3
Other	13	0	13	0.7
Total known	1828	164	1992	

TABLE A-6 Employment status, 1980.

	%
Employed full-time	89
Employed part-time	5
Not employed, not seeking	5
Not employed, seeking employment	1
Total number known	2072
No response	4

TABLE A-7. Type of employer, 1980.

	%
ACADEMIC	46
University	36
College	5
Junior College	1
Secondary School	4
NONACADEMIC	54
Industry/Self-employed	30
Government	11
FER&DC	10
Nonprofit	2
Other	1
Total Number Known Employed	1939

TABLE A-8. Principal work activity, 1980

	%
Teaching	25
Basic research	25
Applied research	20
Development	8
Design/Engineering	7
Administration	10
Other	5
Total number known	1922
No response	21

TABLE A-9. Principal work activity by level of highest degree, 1980.

	Ph D %	Masters[a] %	Bachelors[a] %
Teaching	27	31	7
Basic research	30	7	7
Applied research	22	16	13
Development, Design/ Engineering	9	28	44
Administration	9	10	19
Other	3	8	10
Total number known	**1400**	**285**	**133**
No response	13	4	1

[a]Advanced graduate students are not included.

TABLE A-11 Type of employer by highest degree, 1980

	Ph.D 's %	Masters[a] %	Bachelors[a] %
ACADEMIC	50	38	10
University	44	10	3
College[b]	6	9	1
Secondary school	—	19	6
NONACADEMIC	50	62	90
Industry/Self-employed	24	39	70
Government	11	15	11
FFR&DC	12	3	7
Other	3	5	2
Total number known	**1412**	**289**	**134**
No response	1	0	0

[a]Advanced graduate students are not included.
[b]Most of the Ph D's employed in colleges (90%) are employed in 4 year colleges, most of the Masters (62%) in the 2 year colleges

TABLE A-10. Distribution of society members by company, 1980

Companies Rank order by size	Cumulative percentages Companies	Employees	Relative percentage Employees per company
First	0.4	4.9	4.9
Second	0.7	8.0	3.1
Third	1.0	10.4	2.4
4–6	2.1	16.4	2.0
7–8	2.8	20.1	1.8
9–12	4.2	26.6	1.6
13	4.5	28.1	1.5
14–18	6.3	34.5	1.3
19	6.6	35.6	1.1
20–27	9.4	42.9	0.9
28	9.7	43.6	0.7
29–39	13.5	49.6	0.5
40–66	22.9	59.5	0.4
67–288	100.0	100.0	0.2
Total number known	**288**	**548**	

TABLE A-12 Type of employer by cohort year of Ph D.[a] 1980

	1975 + %	1970–1974 %	1965–1969 %	1960–1964 %	Before 1960 %
ACADEMIC	37	42	50	61	58
University	28	33	43	54	54
Other academic	9	9	7	7	4
NONACADEMIC	63	58	50	39	42
Industry	41	28	20	16	17
Other nonacademic	22	30	30	23	25
Total number known	**218**	**301**	**273**	**201**	**310**
No response	0	0	0	1	0

[a]Includes full-time and part-time employed only Excludes postdocs and self-employed.

TABLE A-13 Type of employer by professional self-identification, 1980

Employer type	Physicists %	Astronomers %	Engineers %	Chemists %	Other Scientists %	Other %	Total %
ACADEMIC	50	57	25	49	58	43	46
University	38	52	22	44	49	12	36
Other Academic	12	5	3	5	9	31	10
NONACADEMIC	50	43	75	51	42	57	54
Industry/Self-employed	24	11	60	31	15	44	30
Government	12	17	7	8	15	3	11
FFR&DC	12	10	4	11	5	—	10
Other	2	5	4	1	7	10	3
Total Number known	**1149**	**88**	**320**	**177**	**129**	**75**	**1938**
No response	3	—	1	—	—	—	

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TABLE A-14. Employer type by sex, 1980.

	Male %	Female %
ACADEMIC	**46**	**51**
University	36	39
Other academic	10	12
NONACADEMIC	**54**	**49**
Industry and Self-employed	30	25
Government	11	11
FFR&DC	10	10
Nonprofit and other	3	3
Total known employed	**1839**	**92**
Not employed	125	7
No response	4	0

TABLE A-15 Age profile by academic rank,[a] 1980.

Birth year cohort	Prof. %	Assoc. prof. %	Asst prof %	Res. assoc. %	Other[b] %
1950 +	—	—	11	30	13
1945–1949	—	7	43	29	24
1940–1944	9	34	32	18	24
1935–1939	24	27	9	12	15
1930–1934	24	15	3	6	7
1925–1929	18	9	2	—	6
1920–1924	14	5	—	2	9
1915–1919	7	3	—	2	2
Before 1915	4	—	—	2	—
Total number known	**339**	**149**	**101**	**66**	**54**
No response	8	0	4	0	2

[a]Includes university and college full-time only Graduate students are not included

[b]Includes administrators, lecturers, instructors, and others.

TABLE A-16. Age profile by tenure status,[a] 1980.

Birth year cohort	Tenured %	Tenure-line %	Other %
1950 +	—	11	20
1945–1949	2	44	28
1940–1944	18	29	20
1935–1939	24	10	14
1930–1934	21	3	9
1925–1929	15	1	2
1920–1924	11	2	4
1915–1919	6	—	2
Before 1915	3	—	1
Total number known	**483**	**92**	**124**
No response	9	3	2

[a]Includes university and college full-time employed only Graduate students are not included.

TABLE A-17 Detailed subfield of work, 1980

	N.	%
Physics and Astronomy	**1231**	**66**
Solid State Physics	135	
Physics Education, college	110	
Optics	103	
Elementary Particles and Fields	77	
Nuclear Physics	74	
Acoustics	71	
Plasma Physics	67	
Chemical Physics	62	
Astrophysics	57	
Atomic and Molecular Physics	56	
Medical Physics	52	
Physics, general	52	
Astronomy	49	
Physics Education, precollege	45	
Biophysics	25	
Mathematical Physics	24	
Fluid Dynamics	23	
Low Temperature Physics	23	
Geophysics	21	
Electronics	18	
Vacuum Science	15	
Crystallography	13	
High Polymer Physics	12	
Electromagnetism	8	
Rheology	7	
Thermal Physics	6	
Mechanics	3	
Physics, other	23	
Engineering	**246**	**13**
Electronic	52	
Systems	32	
Electrical	30	
Mechanical	27	
Nuclear	22	
Aeronautical and Astronautical	19	
Engineering, general	16	
Chemical	11	
Environmental	8	
Engineering, other	29	
Other Science	**286**	**15**
Chemistry	60	
Computer Science	43	
Materials Science	42	
Earth and Environmental Science	26	
Science Administration	23	
Psychology	21	
Biological Science	20	
Mathematics and Statistics	18	
Science, other	33	
Other Areas	**103**	**6**
Educational Administration	28	
Other Administration	39	
Nonscience, other	36	
Total number known	**1866**	
No response	77	

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TABLE A-18. Predominant fields and subfields of work by highest degree, 1980 [a]

	Ph D %	Masters %	Bachelors %
PHYSICS AND ASTRONOMY	68	60	48
Predominant Physics Subfields of Work	Solid State Physics Astronomy/Astrophysics Physics Ed. (Coll) [b] Elementary Particles Nuclear Physics	Physics Ed (SS) [b] Acoustics Optics Physics Ed (Coll) [b]	Optics Vacuum Science Acoustics
OTHER SCIENCE	17	13	10
ENGINEERING	10	21	32
OTHER AREAS	5	6	10
Total Number Known	1364	279	124
No Response	47	10	10

[a] Does not include graduate student
[b] SS–Secondary Schools, Coll–College

TABLE A-19 Principal work activity by type of employer, 1980

	University %	Other academic %	Industry/ Self-employed %	Government %	FFR&DC %	Other %
Teaching	45	91	—	—	—	—
Basic research	38	1	11	31	42	20
Applied research	8	1	31	32	35	20
D. D. E [a]	1	—	37	11	9	[illegible]
Administration	6	7	13	18	12	11
Other	2	—	7	8	2	31
Total number known	695	189	576	211	187	64
No response	9	0	7	1	2	0

[a] Development, Design, Engineering.

TABLE A-20 1980 salaries by type of employer

	Median salary	Mean salary (in thousands of dollars)	Standard deviation	Median age	Total number known	No response
University	29.0	30.0	10.8	43.2	618	28
College	22.8	23.5	6.4	43.6	85	3
Junior College	22.4	22.6	5.3	38.5	24	1
Secondary School	21.7	22.0	5.1	41.5	62	4
Industry/Self-employed	35.0	37.7	13.8	40.7	521	40
Government	36.2	37.1	9.1	42.9	196	9
FFR&DC	34.7	35.1	8.6	41.9	171	12
Other	35.1	36.4	11.9	44.8	58	2

TABLE A-21 1980 salaries by level of highest degree

	Median salary	Mean salary (in thousands of dollars)	Standard deviation	Median age	Total number known	No response
Ph.D	32.2	33.7	11.8	41.8	1312	69
Masters	28.0	30.1	11.5	43.4	272	18
Bachelors	31.5	33.5	15.0	49.4	132	8

TABLE A-22. 1980 salaries by years from highest degree, Ph D.'s.

	Median salary	Mean salary (in thousands of dollars)	Standard deviation	Median age	Total number known	No response
Years from Ph.D						
0–4	25.0	24 6	7.3	31.4	207	11
5–9	29 2	29.4	7.7	36 7	275	13
10–14	32 5	33.1	9.7	40.2	288	14
15–19	35 4	36.8	10.7	45.0	198	12
20 +	40 0	42.1	13 3	54.3	316	17

TABLE A-23. 1980 salaries by major employer type*, Ph.D.'s.

	Median salary	Mean salary (in thousands of dollars)	Standard deviation	Median age	Total number known	No response
University						
9–10 month salary base	27 6	28.9	8.3	45.3	288	2
11–12 month salary base	31 4	32.5	11.9	41 2	219	0
Colleges						
9–10 month salary base	20 6	21 7	4.4	43.0	56	0
Industry/Self-employed	36.0	39.1	13 7	38.7	315	22
Government	37.0	38.0	8 5	42.1	139	5
FFR&DC	35.0	35.3	8.7	41.2	154	12
Other	35.5	38.4	12.9	42.3	37	2

*Sample sizes in other employment areas were too small to be detailed here.

TABLE A-24 1980 salaries by major employer type*, Masters.

	Median salary	Mean salary (in thousands of dollars)	Standard deviation	Median age	Total number known	No response
Secondary School						
9–10 month salary base	21 9	22.0	4.8	40 0	36	0
Industry/Self-employed	33.0	34.8	13 0	43.5	107	8
Government	35 1	34 8	10.5	43.3	40	2

*Sample sizes in other employment areas were too small to be detailed here.

TABLE A-25 1980 salaries by geographic region*, Ph.D 's.

Geographic Region	Median salary	Mean salary (in thousands of dollars)	Standard deviation	Median age	Total number known	No response
New England	32.0	32 4	11.0	39.8	106	10
Middle Atlantic	33 5	35 0	14.2	42.2	241	14
South Atlantic	32 0	33 8	10.5	41.7	206	9
East North Central	31.0	32.5	10.4	43.2	176	12
East South Central	29.3	28.5	7.0	42.8	46	1
West North Central	28 0	28.2	8.7	41.0	50	0
West South Central	29 1	30 5	14 7	40.0	68	5
Mountain	34.0	34.6	9 7	40.8	103	7
Pacific	35.0	35.7	11 8	43 0	275	9

*See Appendix B for state composition of each region.

TABLE A–26 1980 salaries for Ph.D.'s by type of employer and years from degree

Employer type	Years from degree	Median salary (in thousands of dollars)	Mean salary	Standard deviation	Median age	Total number known	No response salary
University (9–10 month salary base)							
	0–4	19.5	19.9	3.5	32.5	18	—
	5–9	21.8	21.6	3.2	36.6	36	—
	10–14	25.0	26.2	6.0	40.6	59	—
	15–19	29.1	28.9	5.2	44.3	55	1
	20 +	35.0	35.1	7.7	54.3	109	1
University (11–12 month salary base)[a]							
	0–4	20.0	21.3	5.6	32.5	14	—
	5–9	26.4	26.6	6.0	35.2	46	—
	10–14	32.1	32.9	8.0	40.4	47	—
	15–19	40.0	39.1	8.2	43.9	35	—
	20 +	44.0	44.4	10.5	55.3	48	—
Industry/Self-employed							
	0–4	29.6	29.6	3.9	31.3	75	7
	5–9	34.8	34.5	6.4	36.7	75	4
	10–14	38.8	40.2	10.6	39.8	68	2
	15–19	42.1	46.8	14.3	45.1	38	4
	20 +	47.8	52.6	19.3	55.5	52	3
Government							
	0–4	29.0	28.3	5.8	31.8	17	—
	5–9	32.0	32.6	5.6	38.5	30	4
	10–14	36.1	37.0	6.7	40.0	35	1
	15–19	39.3	40.1	5.8	44.6	18	1
	20 +	50.0	46.9	4.8	54.3	37	—
FFR&DC							
	0–4	27.5	26.5	6.7	31.6	21	1
	5–9	30.0	30.1	5.2	35.6	35	2
	10–14	34.8	34.8	6.4	40.0	39	4
	15–19	36.4	39.0	7.0	45.3	22	2
	20 +	42.1	43.7	7.1	52.6	34	3

[a]In addition, there are 23 postdocs with known salaries working in universities on an 11–12 month salary base. Their average salary is $14 400

TABLE A–27. 1980 salaries by selected academic ranks and tenure status

	Median salary (in thousands of dollars)	Mean salary	Standard deviation	Median age	Total number known	No response
Professor, Tenured						
9–10 month salary base	31.4	31.9	7.6	48.5	203	1
11–12 month salary base	41.0	42.4	9.7	49.4	87	0
Associate Professor, Tenured						
9–10 month salary base	23.0	23.3	3.6	41.5	80	1
11–12 month salary base	30.0	30.5	4.7	40.8	32	0
Assistant Professor, Tenure Line						
9–10 month salary base	18.3	19.1	2.9	33.1	42	0
11–12 month salary base	26.4	27.5	8.0	35.3	25	0
Research Associate						
11–12 month salary base	20.6	21.6	7.9	34.2	48	0

TABLE A-28. 1979 and 1980 salaries for members continuing emloyment with selected employers.[a]

	Salary year	Median salary	Mean salary (in thousands of dollars)	Standard deviation	Median age	Total number known
UNIVERSITY						
(9–10 month	1979	24.1	25.4	7.1		
salary base)	1980	27.4	29.0	8.2	45.6	202
(11–12 month	1979	27.0	28.0	11.7		
salary base)	1980	30.0	31.7	12.8	41.5	137
COLLEGES						
(9–10 month	1979	17.2	19.0	4 1		
salary base)	1980	20.0	21.8	4.5	44.3	30
SECONDARY SCHOOLS						
	1979	20.0	19.7	4 7		
	1980	21.8	22.0	4.9	41.7	49
INDUSTRY						
	1979	32.2	34 3	12.0		
	1980	37.0	39.3	14.1	42 7	319
GOVERNMENT						
	1979	34.0	34.9	8.6		
	1980	37.0	38.1	8.9	44.5	148
FFR & DC						
	1979	30.0	31.5	7.8		
	1980	34.5	35.4	8.3	41.8	127

[a]Data based on society members who responded in both 1979 and 1980, were full-time employed, and did not change employers in the year 1979–1980

TABLE A-29. 1979 and 1980 salaries for members continuing in the same principal work activity

Principal work activity 1979/1980	Salary year	Median salary	Mean salary (in thousands of dollars)	Standard deviation	Median age	Total number known
Teaching	1979	22.2	24.2	7.9		
	1980	25.4	27 7	10.0	44.3	344
Basic research	1979	27 0	28.2	10.6		
	1980	31.0	32.2	11.0	40.3	319
Applied research	1979	30.0	31 1	8 4		
	1980	35.0	35.6	9.1	39.8	246
Development	1979	31.8	32.5	9.1		
	1980	36.0	37.2	11.3	42.5	91
Design/Engineering	1979	30 0	31.2	10 7		
	1980	34.0	35.8	13.7	47.8	67
Administration	1979	40.0	41.1	14.1		
	1980	43.0	46.0	16.8	50.8	115
Other activities	1979	28.5	31.0	11.7		
	1980	33.5	34.7	10.5	41.2	47

TABLE A-30. 1979 and 1980 salaries by sex and employment sector.*

	Salary year	Sex	Median salary	Mean salary	Standard deviation	Median age	Total number known
			(in thousands of dollars)				
ACADEMIC	1979	Male	24.0	25.4	9.1		
		Female	19 1	20.1	7.4		
	1980	Male	27.2	29.0	9.9	43.9	547
		Female	20.7	22 5	7.0	41.7	24
NONACADEMIC	1979	Male	32 1	34 0	10.6		
		Female	28.1	29.0	7.6		
	1980	Male	36.0	38.3	12.1	43 0	606
		Female	32 0	33.4	8.0	44.0	24

*Data based on members who responded in both 1979 and 1980, were full-time employed, and did not change employers.

TABLE A-31 1979 and 1980 salaries for members changing employers by selected employer type *

Employer type change 1979/1980	Salary year	Median salary	Mean salary	Standard deviation	Median age	Total number known
		(in thousands of dollars)				
University to	1979	17.5	21.4	9 7		
University	1980	23.0	26 1	10.7	34.0	17
University to	1979	18.0	21.1	9 3		
Industry	1980	30.1	37.4	23.7	37 5	19
Industry to	1979	30.0	29 6	10.0		
Industry	1980	34.0	34.7	11.6	38.0	31

*The sample size of other employer type changes is too small to analyze.

TABLE A-32. 1979 and 1980 salaries for members changing and continuing in broad work activiy areas.

Broad work activity 1979/1980	Salary year	Median salary	Mean salary	Standard deviation	Median age	Total number known
		(in thousands of dollars)				
Teaching/Basic Res.	1979	24.5	26 0	9.5		
Teaching/Basic Res.	1980	28.1	29.8	10 7	43 0	673
Teaching/Basic Res.	1979	18.0	20 9	10.2		
to Other Activity*	1980	28.8	30.2	10.9	37.8	39
Other Activity to	1979	32 6	31 5	12.6		
Teaching/Basic Res.	1980	35.0	33.0	12.4	41.5	20
Other Activity	1979	31.0	33.2	11 2		
Other Activity	1980	36.0	37.8	12.7	42 6	600

*Includes Applied Research, Development, Design, Engineering, Administration, etc.

APPENDIX B: Geographic Regions.

NEW ENGLAND
- Connecticut
- Maine
- Massachusetts
- New Hampshire
- Rhode Island
- Vermont

MIDDLE ATLANTIC
- New Jersey
- New York
- Pennsylvania

SOUTH ATLANTIC
- Delaware
- District of Columbia
- Florida
- Georgia
- Maryland
- North Carolina
- South Carolina
- Virginia
- West Virginia
- Puerto Rico

EAST NORTH CENTRAL
- Illinois
- Indiana
- Michigan
- Ohio
- Wisconsin

EAST SOUTH CENTRAL
- Alabama
- Kentucky
- Mississippi
- Tennessee

WEST NORTH CENTRAL
- Iowa
- Kansas
- Minnesota
- Missouri
- Nebraska
- North Dakota
- South Dakota

WEST SOUTH CENTRAL
- Arkansas
- Louisiana
- Oklahoma
- Texas

MOUNTAIN
- Arizona
- Colorado
- Idaho
- Montana
- Nevada
- New Mexico
- Utah
- Wyoming

PACIFIC
- Alaska
- California
- Hawaii
- Oregon
- Washington

APPENDIX C: Dropping Society Membership.

Between 1979 and 1980 a small proportion, approximately 5%, of the original 1979 sample dropped society membership. From a small sample the absolute numbers this produces are, of course, too small to warrant extensive discussion. However, the characteristics of individuals who drop society membership are of interest. An initial picture of some of these characteristics may be gleaned from the 58 individuals who dropped society membership but responded to our 1980 follow-up survey.

They were slightly younger and more likely to hold only a bachelors degree than individuals who remained members of one of the societies. As the following three tables indicate they were also less likely than society members to identify themselves as physicists, be employed in universities and colleges, or be involved in teaching and basic research.

In next year's report when we will have the opportunity to examine the larger group of individuals who have dropped society membership over a two-year span, we will analyze their characteristics in more depth.

TABLE C-1 Professional self-identification of current and dropped society members, 1980

	Dropped members %	Current members %
Physicist/Astronomer	53	64
Engineer	25	16
Other scientist	14	16
Other	9	4
Total number known	**57**	**2075**
No response	1	1

TABLE C-2 Type of employer of current and dropped society members, 1980

	Dropped members %	Current members %
Industry	33	28
Other nonacademic	29	26
University/College	25	41
Junior College/Secondary School	13	5
Total number known	**55**	**1970**
No response	3	106

TABLE C-3 Primary work activity of current and dropped society members, 1980

	Dropped members %	Current members %
Teaching/Basic research	33	50
Applied research	22	20
Development, Design/Engineering	20	15
Administration/Other	25	15
Total number known	**55**	**1954**
No response	3	122

APPENDIX D: Methodology.

In the spring of 1979, the AIP Manpower Statistics Division conducted a short one-page questionnaire survey of a small random sample of the U. S. and Canadian resident membership of the nine AIP member societies. Data from this survey were published in the 1980 AIP publication *"AIP Member Societies Entering the 1980's."* Out of the total sample of 4156 members queried in 1979, 2541 responded yielding a 61% response rate. In the spring of 1980, all individuals in the original 1979 sample were followed up, whether or not they originally responded in 1979. Excluded from the 1980 sample were those known to be deceased ($N = 18$) and members who had moved abroad ($N = 33$). The overall response rate in 1980 on a single wave was 52%: 68% for members who had responded previously, 28% for members who had not responded in 1979 and 24% for those who had dropped membership during 1979. The data in this report refer to individuals who were society members in 1979 and responded in the 1980 follow-up. The body of the report focuses on individuals who were still society members in 1980, although a brief description of individuals who dropped membership was provided in the previous appendix.

To assess the possible bias resulting from nonresponse in our sample, the characteristics of the different subgroups of respondents were analyzed. These subgroups differ most substantially in the rate at which they dropped society membership during 1979 (see Table D–1). Less than 2% of the consistent respondents (those replying in both 1979 and 1980) dropped membership. The inconsistent respondents (those only replying in either 1979 or 1980) were four times as likely to drop membership. In contrast those who never responded were seven times as likely to drop membership. Clearly, then, individuals who dropped membership during 1979 are underrepresented in the consistent respondent subgroup as well as in the total group of all respondents in 1980. However, this bias should not adversely affect the generalizability of this report. Individuals known to have dropped society membership prior to 1980 were removed from the data base prior to all analyses and the report focuses exclusively on individuals who continued society membership into 1980.

Little else is known about individuals who never responded to the questionnaires. Therefore, the data collected in both 1979 and 1980 was analyzed to determine whether there is a relationship between an individual's likelihood to reply repeatedly to our surveys and that individual's characteristics No differences were found in demographic characteristics, e.g., age, sex, race, and citizenship. Only a few statistically significant differences were found in employment characteristics. The only difference between members who replied to the 1980 nonrespondent follow-up and members who were consistent respondents was a minor variation in type of employer. The nonrespondent follow-up group was more likely to work in four-year colleges while the consistent respondents were more likely to be employed in universities in 1980. Members who responded only in 1979 however differed from consistent respondents in several ways: professional self-identification, type of employer, and primary work activity. The one-time 1979 respondents were more likely to be engineers working in industry engaged in design and engineering. The consistent respondents were in 1979 more likely to be physicists or astronomers working in universities engaged in teaching.

TABLE D–1 Rate of dropped membership by respondent subgroup, 1980

	Total number	Dropped membership during 1979 N	%
Responded in 1979 and 1980	1695	28	1 6
Responded in 1979 only	829	49	5 9
Responded in 1980 only	439	30	6 8
Never responded	1142	133	11 6
Totals	4105*	240	5 8

*These data do not include those known to be deceased or individuals living abroad

Although the employment related characteristics of inconsistent respondents differ from those reported by consistent respondents at the same point in time, the direction of these qualitative differences are very similar to the career development patterns observed among members who responded in both years. Members who responded only once in the past two years may have been queried after they had already moved into more nontraditional areas of physics employment. In contrast, consistent respondents were surveyed before and during similar changes. Therefore, our analysis of career mobility may be too conservative. It is possible that society members are moving into industry and applied research and away from the more traditional physics careers at a higher rate than was noted. Inconsistent respondents, members who never responded, and dropped members were followed up again in 1981. The data from that sample survey will be invaluable in assessing further the validity and reliability of the scientific career development patterns reported in this publication.

APPENDIX E: Definitions and Technical Notes.

Employment Status

All salary data are presented for individuals who are full-time employed only. Where feasible, academic salaries reported on a 9–10 month and 11–12 month salary base are presented separately. When overall figures are given, no special weighting factors have been attached. Other employment tables, which do not involve salary data, include both full-time and part-time employed members unless otherwise noted.

Field and Subfield

The field and subfield list which was sent with the questionnaire was used by respondents to indicate the area in which they received their highest degree and their primary subfield of current work. In addition, individuals provided their major professional self-identification: physicist, astronomer, engineer, chemist, biologist, mathematician, other scientist, or other.

Median

The median, a measure which is frequently used in this report, is that point in a distribution above and below which 50% of the values fall. Since it is less influenced by extreme values than the arithmetic mean it is the preferred descriptive measure of central tendency in typically skewed salary and age distributions. In Appendix A both median and mean salaries are presented; observed differences reflect the skewness in the distributions.

Quartiles and the interquartile range

Seventy-five percent of the values in a distribution fall below the third quartile; 25% of the values fall below the first quartile. The interquartile range, the difference between the third and first quartile, is a measure of variation within distributions. It is used in several of the figures to illustrate salary variation.

Sampling Error

The percentages and other measures presented in this report may be affected by different sources of error. The possible effects of response bias were discussed earlier. Since these data are based upon a small random sample, they are also subject to sampling error. The variability introduced by the sampling procedure depends both upon the size of the subgroup being examined and the variation of values in the population.

Confidence intervals for figures presented in this report can be estimated by the following:

proportions:

$$p \pm Z\sqrt{\frac{p(1-p)}{n}},$$

where

p = sample proportion observed,
n = sample size, and
Z = coefficient of confidence, 1.96 at the 95% confidence level.

means:

$$\bar{x} + Zs/\sqrt{n},$$

where

$\bar{x}$ = the arithmetic mean,
s = standard deviation,
n = sample size, and
Z = coefficient of confidence, 1.96 at the 95% confidence level.

medians:

M_1, that point below which p_1^{th} values fall,
M_2, that point below which p_2^{th} values fall,

where

$$p_1 = p + Z\sqrt{\frac{p(1-p)}{n}},$$

$$p_2 = p - Z\sqrt{\frac{p(1-p)}{n}},$$

and

$p = 0.5$,
n = sample size,
Z = coefficient of confidence, 1.96 at the 95% confidence level.

examples:

(1) 27% of the Ph.D.'s were primarily engaged in teaching.

$$0.27 \pm 1.96\sqrt{\frac{0.27(0.73)}{1400}} = 0.25\text{–}0.29,$$

i.e. One can say with 95% confidence that the interval 0.25 to 0.29 covers the true proportion primarily teaching in the society member population.

(2) The average salary for Ph.D.'s primarily engaged in teaching was \$28 900.

$$28\,900 \pm 1.96\,\frac{10\,200}{\sqrt{351}} = \$27\,800\text{–}\$30\,000,$$

i.e. One can say with 95% confidence that the interval \$27 800 to \$30 000 covers the true mean salary in the society member population.

(3) The median age for all society members in 1980 was 42.8, based on a sample of 2096 with known age.

$p_1 = 0.52 \quad M_1 = 43.4$
$p_2 = 0.48 \quad M_2 = 42.2$

i.e. One can say with 95% confidence that the interval 42.2 to 43.4 covers the true median age in the society member population.

AIP MANPOWER STATISTICS DIVISION

MEMBERSHIP SAMPLE SURVEY 1980 UPDATE

PART A

HAVE YOU MADE ANY CHANGES IN THE AREAS LISTED BELOW SINCE MARCH 1979?

If you have made *no changes* check here [ ] NO CHANGES answer PART C and return form in enclosed envelope

If you have made one or more changes, check YES where appropriate below, and complete the related sections(s) in PART B

Areas of possible change			
1) Highest Degree?	No ______	Yes ______	(See B1)
2) Citizenship?	No ______	Yes ______	(See B2)
3) Professional Self-Identification?	No ______	Yes ______	(See B3)
4) Employment Status?	No ______	Yes ______	(See B4)
5) Employer?	No ______	Yes ______	(See B5)
6) Work Activity?	No ______	Yes ______	(See B6)
7) Academic Rank and/or Tenure Status?	No ______	Yes ______	(See B7)
8) Subfield of Work?	No ______	Yes ______	(See B8)

PART B

CHANGES SINCE MARCH 1979. Circle or fill in *new* status only.

1) HIGHEST DEGREE ______________________________

Month and Year Received ______________, Subfield (see list on reverse side) ______________

2) CITIZENSHIP ______________________________

3) PROFESSIONAL SELF-IDENTIFICATION. (Circle ONE) 1-Physicist, 2-Astronomer, 3-Engineer, 4-Chemist, 5-Biologist, 6-Mathematician, 7-Other Scientist, 8-Other

4) EMPLOYMENT STATUS (Circle all applicable) 1-Full Time Employed, 2-Part Time Employed, 3-Not Employed-seeking employment, 4-Not Employed-not seeking employment, 5-Post Doc., 6-Student

5) PLEASE PRINT FULL NAME OF EMPLOYER ______________________________

______________________________ ZIP CODE

6) PRIMARY WORK ACTIVITY (Circle ONE) 1-Teaching, 2-Basic Research, 3-Applied Research, 4-Development, 5-Design/Engineering, 6-Administration, 7-Other

SECONDARY WORK ACTIVITY: (Circle ONE) 1-Teaching, 2-Basic Research, 3-Applied Research, 4-Development, 5-Design/Engineering, 6-Administration, 7-Other

7) ACADEMIC RANK ______________________ TENURE STATUS. 1-Tenured, 2-Tenure Line, 3-Other

8) SUBFIELD OF WORK (See list on reverse side)

PRIMARY ______________ 1-Theoretical, 2-Experimental, 3-Neither

SECONDARY ______________ 1-Theoretical, 2-Experimental, 3-Neither

PART C

ANNUAL SALARY $ ______________________

academic, is salary base 1-(9 or 10 months), 2-(11 or 12 months)

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AIP MANPOWER STATISTICS DIVISION

MEMBERSHIP SAMPLE SURVEY

PLEASE

Print numbers clearly in boxes as follows:
0123456789.
For checkoffs, use the digit '1' in place of check marks
USE A NUMBER 2 PENCIL

BACKGROUND INFORMATION

(1) MAJOR PROFESSIONAL SELF-IDENTIFICATION (SELECT ONE)

PHYSICIST ☐ ASTRONOMER ☐ ENGINEER ☐ CHEMIST ☐ BIOLOGIST ☐ MATHEMATICIAN ☐ OTHER SCIENCE ☐ OTHER ☐

HIGHEST DEGREE

(2) LEVEL
PHD ☐ MASTERS ☐ BACHELORS ☐ OTHER ☐

(3) DATE REC'D
MONTH ☐☐ YEAR ☐☐

(4) PRIMARY SUBFIELD OF DEGREE
(SELECT ONE FROM ATTACHED LIST) ☐☐☐ THEORETICAL ☐ EXPERIMENTAL ☐ NEITHER ☐

(5) DATE OF BIRTH
MONTH DAY YEAR ☐☐☐☐☐☐

(6) SEX
MALE ☐ FEMALE ☐

(7) CITIZENSHIP
US ☐
NON US PERMANENT VISA ☐
NON US TEMPORARY VISA ☐

(8) RACE/ETHNIC
WHITE ☐ BLACK ☐ ORIENTAL ☐ OTHER ASIAN ☐
NATIVE AMERICAN INDIAN ☐ MEXICAN AMERICAN ☐ PUERTO RICAN ☐ OTHER ☐

CURRENT EMPLOYMENT STATUS

(9) EMPLOYED
FULL TIME ☐ PART TIME ☐

NOT EMPLOYED
SEEKING ☐ NOT SEEKING ☐

(10) POST DOC?
YES ☐ NO ☐

(11) STUDENT?
YES ☐ NO ☐

INFORMATION ON CURRENT EMPLOYMENT

IF CURRENTLY EMPLOYED, PLEASE COMPLETE THE FOLLOWING

(12) TYPE OF EMPLOYER

UNIVERSITY ☐ COLLEGE ☐ JR COLLEGE ☐ SECONDARY SCHOOL ☐ INDUSTRY ☐ GOVERNMENT ☐ FEDERALLY FUNDED R & D CENTERS (eg Argonne) ☐ NON PROFIT ☐ SELF EMPLOYED ☐ OTHER ☐

IF ACADEMIC, (ANSWER a and b)

a) PRIMARY ACADEMIC RANK
PROFESSOR ☐ ASSOC PROF ☐ ASST PROF ☐ LECTURER/INSTRUCTOR ☐ RESEARCH ASSOCIATE ☐ ADMINISTRATOR ☐ OTHER ☐

b) TENURE STATUS
TENURED ☐ TENURE LINE ☐ OTHER ☐

(13) PLEASE PRINT FULL NAME OF EMPLOYER

____

____

EMPLOYER ZIP CODE ☐☐☐☐☐

PLEASE DO NOT ☐☐☐☐☐☐ MARK THESE BOXES

(14) FIELD OR SUBFIELD OF WORK (INDICATE PRIMARY AND SECONDARY) (SEE ATTACHED LIST)

		THEORETICAL	EXPERIMENTAL	NEITHER
1)	☐☐☐	☐	☐	☐
2)	☐☐☐	☐	☐	☐

(15) TYPE OF WORK ACTIVITY
(INDICATE PRIMARY AND SECONDARY)

	TEACHING	BASIC RESEARCH	APPLIED RESEARCH	DEVELOPMENT	DESIGN/ENGINEERING	ADMINISTRATION	OTHER
1)	☐	☐	☐	☐	☐	☐	☐
2)	☐	☐	☐	☐	☐	☐	☐

(16) ANNUAL SALARY

$ ☐☐ , ☐☐☐

IF ACADEMIC INDICATE SALARY BASE 9-10 MOS ☐ 11-12 MOS ☐

SUBFIELD LIST

PHYSICS & ASTRONOMY

001 ASTRONOMY
040 ASTROPHYSICS
070 ACOUSTICS
100 ATOMIC AND MOLECULAR PHYSICS
130 BIOPHYSICS
160 CHEMICAL PHYSICS
190 CRYSTALLOGRAPHY
220 ELECTROMAGNETISM
250 ELECTRONICS
280 ELEMENTARY PARTICLES & FIELDS
310 FLUID DYNAMICS
350 GEOPHYSICS
380 HIGH POLYMER PHYSICS
410 LOW TEMPERATURE PHYSICS
440 MATHEMATICAL PHYSICS
470 MECHANICS
500 MEDICAL PHYSICS
530 NUCLEAR PHYSICS
560 OPTICS
590 PLASMA PHYSICS
620 RHEOLOGY
650 THERMAL PHYSICS
680 SOLID STATE PHYSICS
740 VACUUM SCIENCE
760 PHYSICS, GENERAL
790 PHYSICS EDUCATION, PRE-COLLEGE
800 PHYSICS EDUCATION, COLLEGE
820 PHYSICS, OTHER

ENGINEERING

835 AERONAUTICAL & ASTRONAUTICAL
840 CHEMICAL
845 ELECTRICAL
850 ELECTRONIC
855 ENVIRONMENTAL
860 MECHANICAL
865 NUCLEAR
870 SYSTEMS
890 ENGINEERING, GENERAL
891 ENGINEERING, OTHER

OTHER SCIENCE

895 BIOLOGICAL SCIENCE
900 CHEMISTRY
905 COMPUTER SCIENCE
910 EARTH & ENVIRONMENTAL SCIENCE
915 MATERIALS SCIENCE
920 MATHEMATICS & STATISTICS
925 PSYCHOLOGY
945 SCIENCE ADMINISTRATION
950 SCIENCE, OTHER

OTHER AREAS

955 EDUCATIONAL ADMINISTRATION
975 OTHER ADMINISTRATION
999 NON-SCIENCE, OTHER