AIP Member Societies entering the 1980's

Professional self-identification, employer, work activity,subfield and salary all show a wide variation in this statistical sampling of society members.

Beverly Fearn Porter

The nine Member Societies and their nearly 60 000 members have moved into a new decade, a decade with the promise and the problems of a steady-state environment. For six of the societies this will be their sixth to ninth decade of existence: The American Physical Society and the American Astronomical Society founded in 1899, followed by the Optical Society of America in 1916, the Acoustical Society of America and The Society of Rheology in 1929, and the American Association of Physics Teachers in 1930. The remaining three emerged, in their present form, after World War II: The American Crystallographic Association in 1949, the American Vacuum Society in 1953, and finally the American Association of Physicists in Medicine in 1958. Each decade has presented opportunities which the societies have explored and problems which they have weathered; this new decade will be no exception.

The nine societies differ in their size, their composition, and the directions of their primary interest. Yet they are united in their commitment to furthering the advance of science and technology, both in physics and related disciplines.

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Since it is the membership of these societies who will produce many of the advances of the 1980's and the ensuing decades, this report concentrates on them, in concert, and in their specific societal affiliations.

In the spring of 1979, the AIP Manpower Statistics Division conducted a short, one-page survey of a small random sample of the US membership of the nine Member Societies. (Approximately 14% of the membership is made up of foreign members, living abroad. They were not contacted in this preliminary sample survey.) A single questionnaire mailing brought a 61% response, ranging by society from a high of 65% to a low of 54%. The questions asked were basically demographic and employment oriented: sex, age, citizenship, employment status, employer, work activity, income and so on.

In this summary of results from the survey we will examine the 1979 composition of the membership of all the AIP Member Societies together, and present some selected data that may be of interest in comparing the different societies.

Future reports will compare these data with additional information being obtained this year and later in the 1980's, and should present the societies with a picture of the changing trends in their membership. Although similar trend data from the past is not available for most societies, in those cases where some material is available it will also be included in future reports.

Total membership

The total membership of the nine AIP Member Societies reflects considerable diversity. While more than half of the society members identify themselves as physicists, a broad spectrum of other scientists and engineers are also represented, making up a full 40% of the membership. It may be noted from figure 1 that nearly one out of every five society members identifies him or herself as an engineer. The members received their highest degrees in a variety of subfields with the major ones being solid-state physics, nuclear physics, elementary particles, general physics, astronomy and astrophysics, and electrical and electronic engineering. Two-thirds of those with research degrees classified themselves as experimentalists.

PhD's predominate among the society membership; however, a substantial number of master's and bachelor's degree holders are also in evidence. Belying any image of scientific societies

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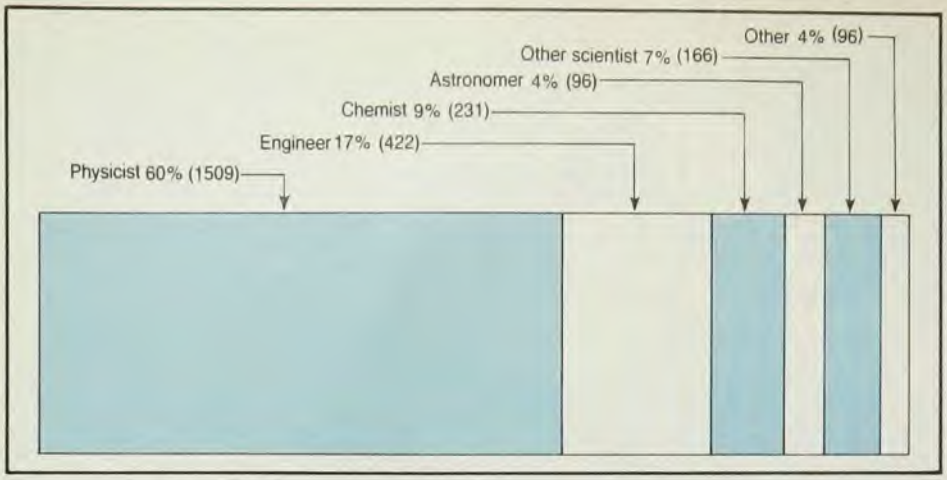


Professional self-identification. Society members were asked what broad discipline they identified themselves with. More than half indicated they were physicists, and a fifth saw themselves as engineers.
Figure 1

as bastions only of the older scientist, we find that most society members received their highest degrees during the past two decades—over 40% in the 1970's. PhD's were more likely than the nonstudent master's and bachelor's degree holders to have received their degrees in the past decade. The median age of society members in 1979 was 43, and nearly one-fifth were under thirty, including advanced graduate students who made up approximately 10% of the membership.

On the other background factors, however, the society members showed considerably less diversity. Only 5% of the society members are female; only 8% are members of specified minority groups. Most of the minority group members are Oriental and other Asian, including both US and non-US citizens. Black, American Indian and Hispanic groups, combined, make up less than 2% of the membership.

Nearly 90% of the society members are employed full-time. A very small percentage is unemployed—that is, not employed but seeking employment. The "unemployed rate" (the number not employed and seeking employment, divided by the labor force) is 1.6%. Those who are employed part-time and those who are not employed are primarily advanced graduate students or retired.

Employer

Slightly more than half of the society membership is nonacademically employed: 29% in industry, 11% in government, 10% in federally funded R&D centers and 3% in other nonacademic organizations. Academe employs 47% of the membership, primarily in the universities and four-year colleges.

Where individuals are employed is primarily influenced by their levels of highest degree. Figure 2 illustrates the varying patterns of employment, omitting advanced graduate students who are employed part-time in universities as teaching and research assistants. The PhD society members, who represent two-thirds of all society membership, are nearly evenly split between academic and nonacademic employment. Those employed in academe are most heavily concentrated in the universities; those employed in nonacademic institutions are primarily found in industry with, however, a substantial proportion also employed in government installations and Federally Funded Research and Development Centers. The young PhD's are more likely than the older ones to be nonacademically employed.

Among the master's degree holders, the balance tips further towards nonacademic employment, and the nature of academic employment changes. Those in academe are more likely, than the PhD society members, to be employed in secondary schools and junior colleges. Those in the nonacademic sphere are more concentrated in industry and government and less in the FFRDC's than the PhD's.

The bachelor's degree holders are most heavily concentrated in nonacademic employment, particularly industry.

There is also some variation in type of employer by professional self-identification. Those who identify themselves as astronomers are most likely to be academically employed; those who identify themselves as engineers are most likely to be employed outside of academe, particularly in industry. Physicists are evenly split.

Although the number of women in the sample is small, the differences in employer distribution between male and female physicists is striking enough to be noted. Women physicists are more likely to be academically employed than male physicists. The major differences are in other academic employment (colleges and high schools) where twice as high a percentage of women are employed than men (20% versus 10%) and industrial employment where approximately twice as high a percentage of men are employed than women (30% versus 16%).

Society members are involved in a broad variety of work activities as illustrated in figure 3. While research, both basic and applied, is the major work activity, a substantial number of society members are also involved in teaching, development, design and engineering, and administration.

An individual's primary work activity is heavily influenced by where he is employed. In the academic areas, there is a clear difference between those employed at universities and in other academic institutions. Almost all of the latter group are primarily engaged in teaching, while at the universities there is a fairly even distribution between teaching and research. In industry the major activities are development and engineering followed by applied research. Only a small proportion is primarily involved in basic research. In government there is a greater emphasis on research with about one-third engaged in basic and another one-third in applied research. Research, however, is *most* predominant at the FFRDC's with a somewhat heavier concentration on basic than applied research. The nonprofit organizations are the most diversified with one-quarter of the members employed there being involved in unlisted activities. Administration involves between 12% and 17% of those in the nonacademic sectors, a lower proportion in academe.

Of the PhD's employed in academe, over 60% are tenured, 15% are in a tenure line while nearly one-quarter are holding temporary postdoctoral or other nonfaculty academic positions.

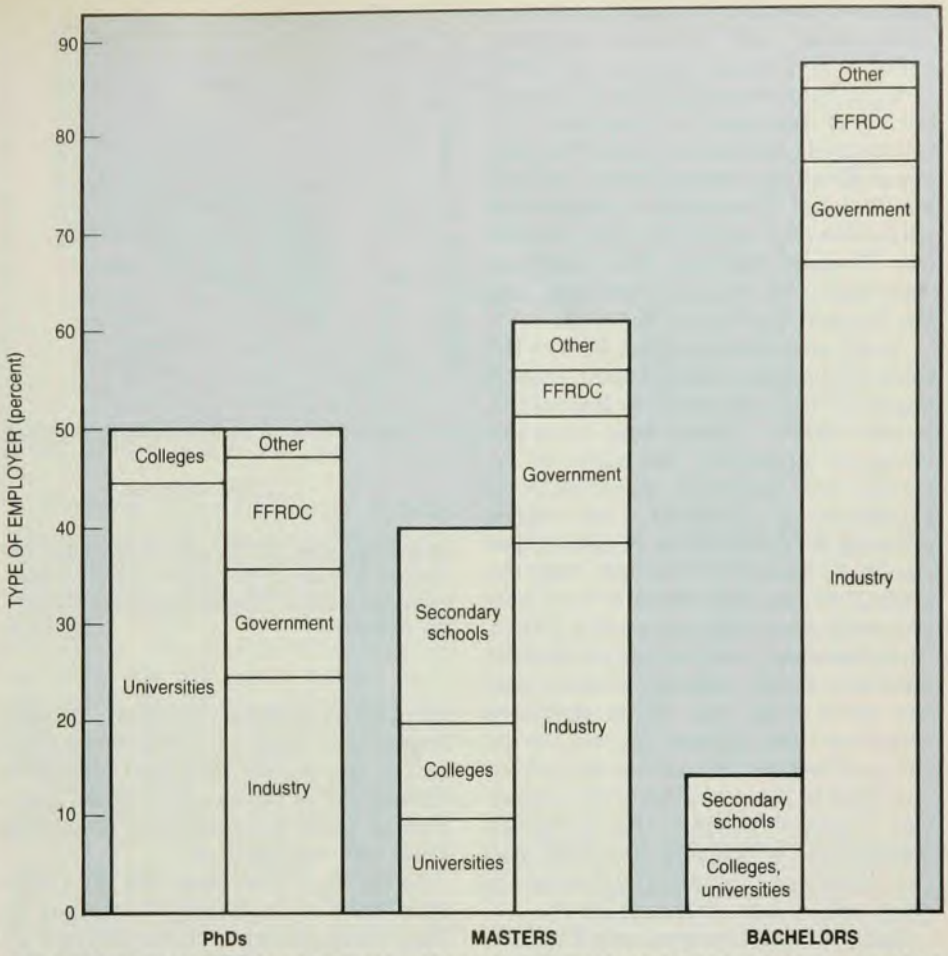
Subfield of current work

Nearly two-thirds of AIP Society Members are currently working in physics and astronomy, down slightly from those who had received their degrees in these areas. Thirty percent are working in other science and engineering and five percent in nonscience areas. Solid state is again the major physics subfield, although there has been outmobility since the degree. As the table on page 31 illustrates, the subfields that have undergone major losses between degree and current work have been: nuclear physics, atomic and molecular physics, elementary particles, and solid-state physics. The subfields which have shown major increases between degree and current work have been: medical physics, acoustics, fluid dynamics, geophysics, and optics. Astronomy, biophysics and plasma physics have remained stable.

What subfield an individual is involved in is strongly related to the level of his highest degree. Since three-quarters of the society members are PhD's or advanced graduate students on the way to the PhD, the previous discussion most heavily reflected their involvement.

Nonstudent master's and bachelor's degree holders have a somewhat different pattern of involvement than their PhD colleagues. They are somewhat less involved in physics, and more involved in engineering. The nature of the physics subfield involvement also differs. Master's degree holders are heavily involved in science education both at the secondary school and college level. The major substantive physics subfields in which the master's and bachelor's degree holders are involved are acoustics and optics. Few are found in such primary PhD subfields as elementary particles, astronomy, astrophysics or nuclear physics.

For all degree holders, electronic engineering is one of the major engineering work areas. For master's degree holders, systems engineering is also central. In the related science areas, chemistry is predominant among the PhD's, computer science and statistics among the master's degree holders. At all three levels, there is involvement in materials science.



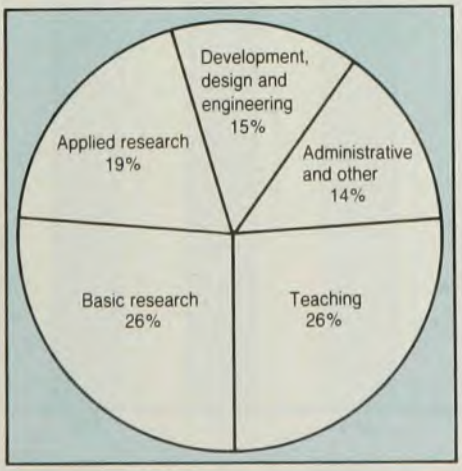
Type of employer by highest degree. These data exclude the advanced graduate students who are employed part-time in universities as teaching and research assistants. Half of the PhD's (who make up two-thirds of all society membership) are in academic employment. Figure 2

Salaries

Current salaries are affected by a variety of factors: level of highest degree, type of employer, years of experience, sex, and so on. Frequently these factors are intertwined. The present sample is too small to enable a full untwining; however, it can present a broad picture of the basic salary structure which exists for society members.

In 1979 society members had average annual salaries of nearly $30 000 with most salaries ranging from the high teens to the low forties. By level of highest degree we find the median salaries of PhD's to be $28 000, masters $24 000 and bachelors $28 900. The surprisingly high bachelors' salaries are due to two factors: their advanced age and their heavy concentration in industrial and government employment. The somewhat depressed master's degree salaries are due to their greater representation in colleges and secondary schools where salaries are the lowest.

Average salaries, both median and mean, also vary by type of employer. Academic salaries are considerably below those in the various nonacademic areas. This is particularly true in secondary schools and colleges, where median salaries drop below $20 000. Median government and industrial salaries, $32 900 and$31 500 respectively, are the highest, with those in the FFRDC's and non-profit organizations being slightly lower. The small group of society members who are self-employed on a full-time basis earn comparatively high salaries. However, the large disparity between their mean and median salaries, $35 000 and $30 300 respectively, indicates that salaries in this group are skewed with considerable variability present.



Primary work activity. Teaching and basic research occupy about a quarter of the members each, and almost as many are in applied research. Figure 3

Figure 4 examines average salary by years from degree for PhD's. (Master's and bachelor's degree holders were too diverse and too small in number in this sample to examine in further detail.) As the graph indicates, recent PhD's have average salaries around $21 000. The salaries gradually increased with experience, peaking and leveling under $40 000 for those with twenty and more years of experience. Variation in salaries also increases with time, particularly as some society members move into administrative career lines.

The Member Societies compared

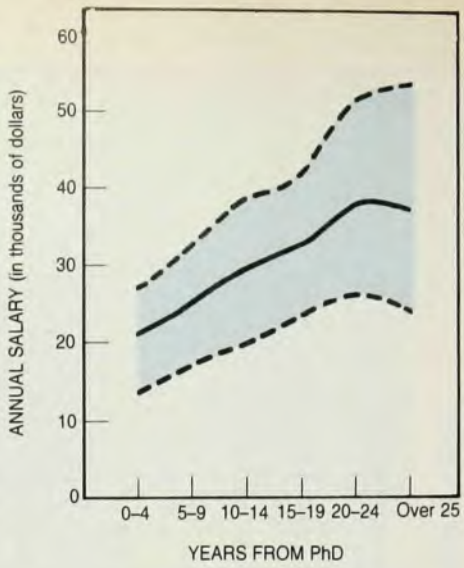
The nine AIP Member Societies vary on a number of dimensions. Comparisons in a few areas will be presented here. In each of these comparisons and discussions of individual societies, it should be kept in mind that the sample, although randomly selected, is small in absolute size. Some fluctuation in actual percentages may thus be expected, particularly for the smaller societies.

Although we are treating each of the societies separately, it should be noted that membership in one society is not exclusive of membership in another. A fair amount of overlap, that is multiple society membership, exists. The extent of overlap varies by society. A

relatively high percentage (36%) of the American Association of Physics Teachers members belong to one or more other AIP Member Societies, while only a small proportion (10%–15%) of the members of the Acoustical Society of America, the American Crystallographic Association, and The Society of Rheology indicate such multiple membership. The major societies with which overlap occurs are The American Physical Society, the American Association of Physics Teachers, and the Optical Society of America.

As we mentioned earlier, 42% of the society members received their highest degrees, PhD's, Master's, or Bachelor's, in the 1970's. There was, however, variation by society. As might be expected the American Association of Physicists in Medicine, the fastest growing of AIP Member Societies, and the most recently founded, has the highest proportion (60%) of members receiving their degrees in the 1970's. The American Astronomical Society, another rapidly growing society, also has more than half of its members receiving their highest degrees during the past decade. In contrast only about one-third of the members of the American Vacuum Society, the American Association of Physics Teachers and the American Crystallographic Association are recent degree holders.

Sample members were asked to indicate their major professional self-identification: physicist, astronomer, engineer, chemist, biologist, mathematician, other scientist, or other. As was indicated in figure 1, while more than half of the society members identified themselves as physicists, a broad spectrum of other scientists and engineers were also represented.



Annual salaries of PhD's (in 1979) versus the number of years experience. Colored lines show one standard deviation above and below the average. Figure 4

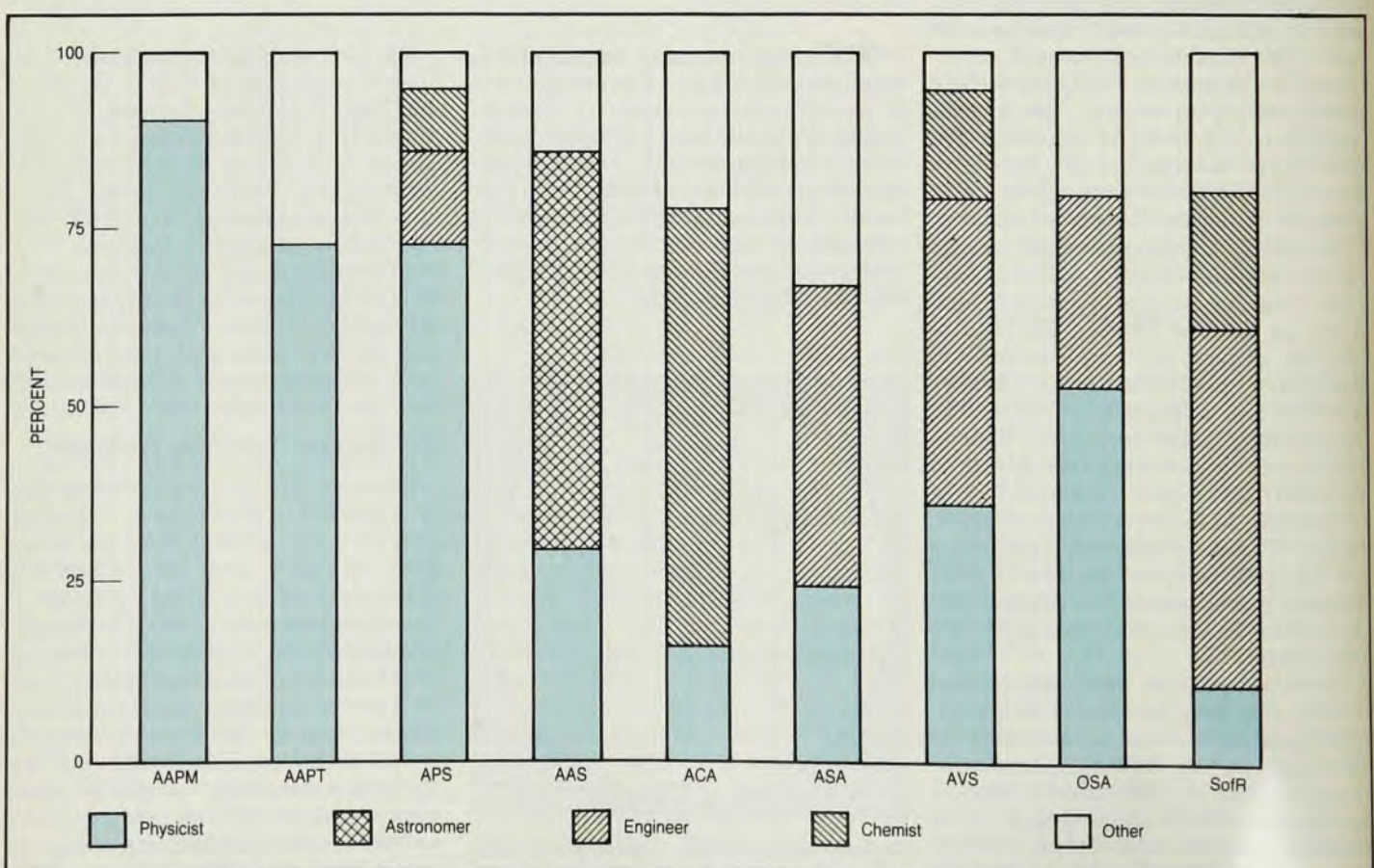
As figure 5 illustrates, the nine societies show considerable variation in their composition. Three-quarters or more of the members of the AAPM, the AAPT, and the APS consider themselves physicists. The APS also has a small but noticeable percentage of engineers and chemists among its members. The AAPT has a broad scattering of individuals from a number of professional areas. More than ten percent of the membership identify themselves as nonscientists; many of these individuals noted that they consider themselves general educators.

In two of the societies, the AAS and the ACA, over half of their members identify themselves with specified other scientific groups. Nearly 60% of AAS members consider themselves astronomers, in contrast to 30% who consider themselves physicists. In the ACA, the dominant group are chemists representing over 60% of the membership.

Finally, four of the societies have a substantial proportion of their membership who consider themselves engineers: The SoR with 60%, the AVS with 45%, the ASA with 44%, and the OSA with 30%. The AVS and the SoR also have a noticeable proportion of chemists among their members. One-fifth of the ASA members consider themselves "other scientists, not specified." Other inquiries suggest that most of these other scientists are psychologists and audiologists.

Each of the nine societies thus show different patterns of membership composition reflecting their major interest and involving a rich mix of physicists, related scientists, engineers, and nonscientists.

We saw earlier that half of the soci-



Professional self-identification for the members of each society. At least three-quarters of AAPM, AAPT and APS members consider themselves physicists; AAS, ACA, ASA and SoR include relatively few physicists. Figure 5

ety members were academically employed and half were employed in a variety of nonacademic areas. As figure 6 indicates, there is clear variation in type of employer among the nine member societies.

As might be expected, the AAPT has the heaviest academic concentration (81%). However, even within this society there are a number of members with nonacademic affiliations. The AAPT is also the only society which has a broad academic distribution, including members teaching at universities, four- and two-year colleges, and secondary schools. Few junior-college or secondary-school teachers belong to any of the other AIP Member Societies.

The members of the AAS and the AAPM are also primarily employed in academe (55% and 52%, respectively), but here the concentration is primarily in the universities. The major nonacademic employer for AAS members is the government; for AAPM members it is the nonprofit organizations, primarily hospitals.

The large APS and the relatively small ACA are almost evenly split between academic and nonacademic employment with a slightly higher nonacademic component than those societies previously discussed. In both cases university employment is predominant among the academics and industrial employment among the nonacademics, although members working for the government and, in the APS, the FFRDC's are also well represented.

Subfield Decline and Growth

Selected subfields	Percent change degree-work	Degree number	Work number
Decline			
Nuclear Physics	− 58	227	95
Atomic and Molecular Physics	− 52	133	64
Elementary Particles	− 49	158	81
Solid State Physics	− 43	284	163
Growth			
Medical Physics	+ 136	28	66
Acoustics	+ 76	51	90
Fluid Dynamics	+ 60	20	32
Geophysics	+ 53	15	23
Optics	+ 44	82	118

Members of the remaining societies are more heavily based in the nonacademic sphere, with approximately two-thirds of SoR, ASA, and OSA members and over 80% of AVS members thus employed. For each of these societies industry was the major nonacademic employer; the ASA and the OSA also had a substantial number of their members in government.

We see, then, that diversity exists among the society members; professional self-identification, employer, work activity, subfield, salary—all show wide variation. While it is true that white male PhD's still account for the majority of society members, the activity of women, minorities, and master's/bachelor's degree holders also show their influence.

The rich diversity illustrated in this article reflects both the varied nature of the physics-related science enterprise and the nine unique, independent (although sometimes overlapping in membership) societies which are affiliated with AIP.

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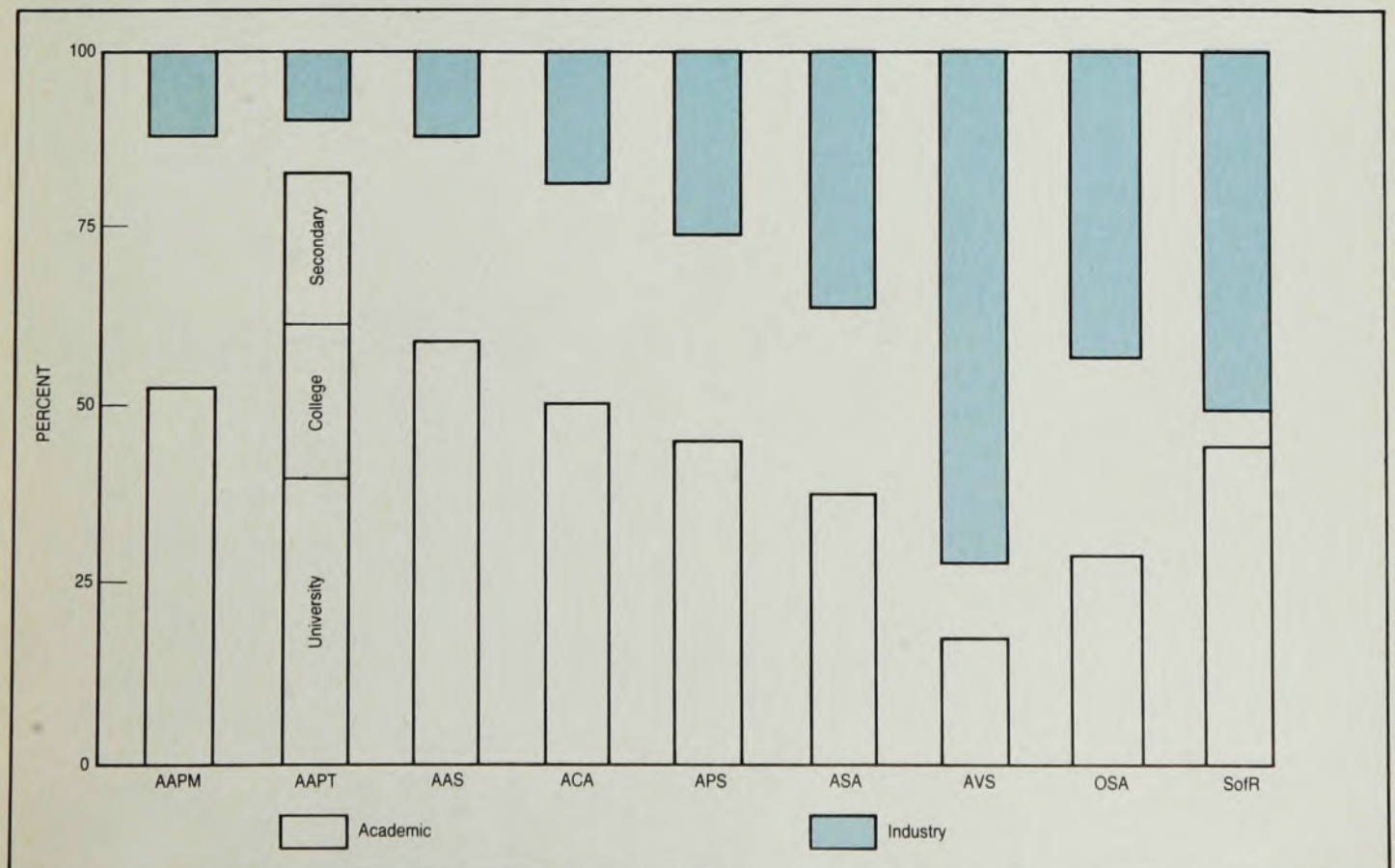
This article is an adaptation of a more complete report distributed by the Manpower Statistics Division of AIP, which issues this and other reports on related matters. Single copies of the report summarized here are free; multiple copies are also available, priced on request. Write to: Manpower Statistics Division, American Institute of Physics, 335 East 45th Street, New York, N.Y. 10017. □



Type of employer for members of each society. These data show that AAPT has the heaviest concentration of members in academic employment (some of them in two-year colleges and secondary schools); AVS has the fewest academic members. Figure 6