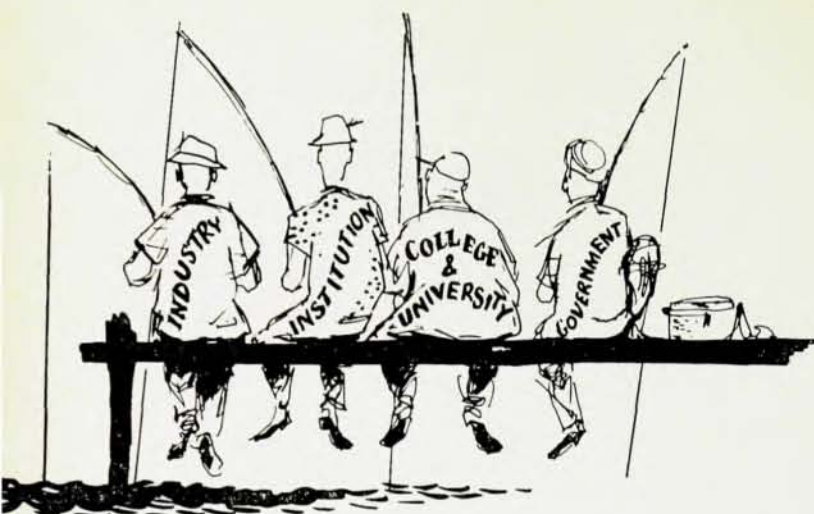




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EMPLOYMENT PREFERENCES of PHYSICISTS

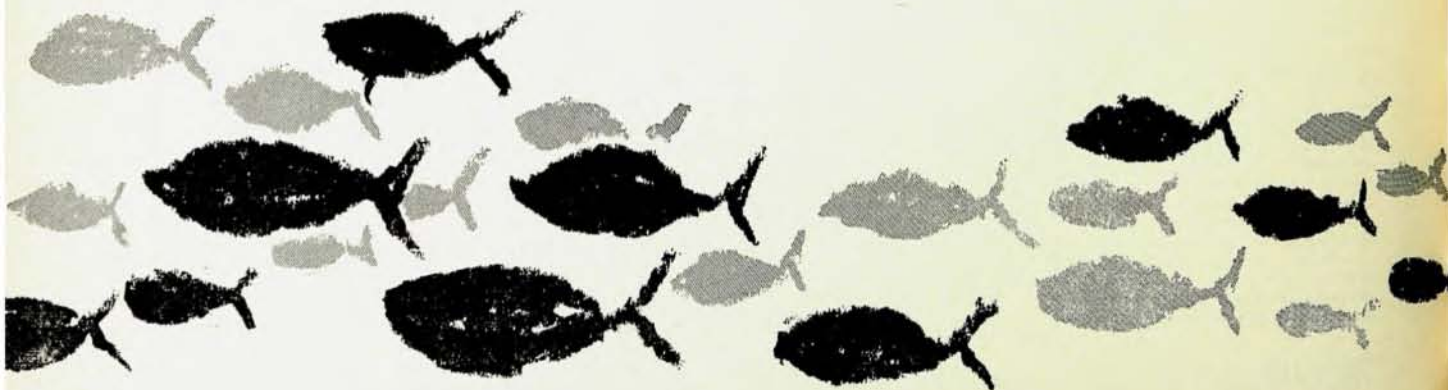
By J. N. Gadel and G. A. Peters

THE effort being expended to recruit physicists prompted the authors to look into the preferences of physicists seeking employment. A convenient, although possibly biased, sample of such physicists consists of those utilizing the Placement Service of the American Institute of Physics.¹

A registrant with the Placement Service completes a personal data sheet on which he lists his preferred types of employment (e.g., industry, university, government),

¹ This sample was suggested by Dr. E. N. Clark, Picatinny Arsenal.

minimum acceptable salary, degrees, and experience. The personal data sheets of physicists registered during the first quarter of 1957 were published by the American Institute of Physics as the "Registrant's Qualification Booklet". The 209 physicists whose data sheets comprised the Booklet constituted the original sample. Seven data sheets were not tabulated for various reasons, thereby reducing the final sample to 202. These 202 physicists were divided into three groups on the basis of academic attainment, as follows:



1. Bachelor's degree awarded or expected within six months (34 physicists).
2. Some graduate work done, but not yet within two months of the award of the PhD (98 physicists).
3. The PhD has been awarded, or is expected within two months (70 physicists).

The personal data sheet lists eight types of employment and allows space for one "write-in" choice. These choices were reduced to four by placing in separate categories all preferences involving affiliation with (1) Colleges and Universities, (2) Government, (3) Industry, and (4) Nonprofit Research Institutions.

The distribution of employment preference by academic level is shown in Table 1. The most important facts are:

1. The percentage of physicists expressing preference for college or university positions increases sharply as academic level increases.
2. Conversely, the percentage preferring industry declines sharply as academic level increases.
3. Nonprofit research institutions, which rank third with all physicists, attract a constant proportion, independent of academic level.
4. Government attracts the smallest proportion of physicists at each academic level.

The difference between institutions, the third choice with all physicists, and government, the last choice, is statistically significant (0.01 level).

The minimum acceptable salaries listed on the personal data sheets were tabulated and are shown in

Table 1. As would be anticipated, the minimum salaries expected from colleges are less than those expected from any other type of employer. This trend is most pronounced among PhD's: they are willing to accept almost \$2000 less per year from colleges than from industry, although, as Table 1 shows, academic positions are twice as popular as industrial positions. Apparently, salary is not of primary importance to physicists.

The competitive positions of the four categories of employers of physicists may be seen by comparing the normalized percentages with the actual distribution of physicists, shown in Table 1. Institutions appear to be in a very favorable position since the normalized percentage is almost five times the proportion of physicists actually employed by institutions. Institutions, thus, should be able to exercise considerable selectivity.

The competitive position of colleges and universities is also favorable. In fact, the normalized percentage based upon all physicists underestimates the strength of their position, since PhD's are more attracted than are other physicists to academic positions. It is essential that this favorable position be maintained, for far from all competent physicists make gifted teachers.

Industry appears to be in short supply, a situation which certainly has been suggested by recent recruiting efforts. As Table 1 indicates, the shortage becomes more acute with increasing academic level. Against this background, the scheme of vigorously recruiting those with bachelor's degrees and then sponsoring graduate study appears very sound.

Table 1. Employment Preferences and Minimum Salaries

	BS N=34		Graduate N=98		PhD N=70		All Physicists N=202			1955 Distribution of U.S. Physicists
	%	Salary	%	Salary	%	Salary	%	Salary	Normal- ized %	
College & University	26.5	\$4200	62.2	\$5921	81.4	\$6792	62.9	\$6216	40.0	40.5%
Industry	85.3	5500	53.1	6843	40.0	8730	54.0	7008	34.4	40.5
Institution	26.5	5233	*	28.6	6514	*	28.6	6874	18.0	3.9
Government	17.6	5060	*	9.2	6888	*	12.9	6894	7.6	15.0
Average		5184		6428		7614		6665		

Notes:

1. Many physicists indicated more than one preference and more than one minimum acceptable salary.
2. The minimum acceptable salaries shown are averages.
3. Statistical significance of the percentages is treated as follows: If the probability that a given difference occurred by chance is greater than 0.2, the difference is considered not significant and an asterisk is used to designate the pair. Significance is considered doubtful if the chance probability is between 0.05 and 0.2, and such pairs are indicated by a question mark. If the chance probability is 0.05 or less, the difference is considered significant and no indication is made. The percentages in the "All Physicists" column were compared only with each other.
4. The normalized percentages differ from the other percentages in this table in that they were adjusted to add to 100.0%.
5. Data on 1955 distribution of physicists taken from M. W. White, *Physics Today*, pp. 32-36, Jan. 1956.

The unpopularity of government prompted a more detailed examination of the records of those indicating a preference for this type of employment. The most notable feature of this group was its multiplicity of choices. While the entire sample of physicists averaged only 1.6 choices, this group averaged 3.5 choices of a possible 4. Further, 67% of the group listed all four choices. The lack of selectivity on the part of these physicists suggests curiosity rather than serious interest. The normalized percentages shown in Table 1 represent the fraction of physicists which each category of employer can expect to obtain, assuming that each "captures" the same fraction of those originally expressing an interest. If government attracts a higher proportion of the merely curious, it will obviously fail to "capture" even its normalized percentage. Obtaining its normalized percentage will not suffice, however, for this percentage (7.6%) differs considerably from the percentage (15%) of all US physicists employed by the government. This difference is statistically significant (0.01 level) and therefore suggests that government may not be able to retain its present share of physicists. The plight of government is likely to be compounded by the fact that in any mutual choice process, the least attractive of both sides are forced to choose each other. In the present case, this principle indicates that government, the least attractive employer, will obtain the least competent physicists.

In attempting to explain the preferences of physicists, we should first recognize that all physicists have much in common: scholarship and interest in science. Were it not for these characteristics, those with the bachelor's degree would not have remained in college for four years studying what many consider a difficult, demanding subject. While the authors do not presume to explain completely the data, the following hypotheses are offered:

1. Academic life is liked or at least well tolerated by physicists. More than 75% of the registrants were in college when the preferences were expressed; acceptance of an academic position clearly involves the least change.
2. Government employees are the objects of a certain amount of humor concerning bumbling, officiousness, red tape, and inefficiency. Scientists, and scholars in general, are probably more repelled than others by formality and red tape.
3. Discussions of "witch hunts", guilt by association, secret denunciations, abuse by Congressional committees, and intolerance of individuality are taken more seriously by intellectuals than by most citizens. Since most physicists have had no personal experience with government employment, and since they almost never see any defense of government procedures or positions, they must assume that these charges might be true, and, hence, are reluctant to accept positions in government laboratories.
4. While industrial positions are felt by some to put the scientist under undue pressures which result in superficial goals and methods, it is commonly recognized that industrial salaries are the highest. Despite

the fact that many physicists in industry must obtain security clearances, "witch hunts" and other undesirable phenomena are not associated with industry. The goals of industrial laboratories are strictly defined in terms of their products and competitive positions, but colleges, institutions, and government have neither products nor competitive positions. The limited scope of industrial goals operates in both directions, tending to attract those with less theoretical, and repel those with more theoretical, interests.

5. Institutions tend to be unknown: fewer than 4% of the physicists registered with the NSF-AIP Register are employed by institutions. The lack of publicity about institutions tends to make even their names difficult to recall. While institutions are less attractive than colleges and industries, they do not suffer from the negative associations of government. The position of institutions shown in Table 1 is, as might be expected, intermediate.
6. The popularity of industry steadily declines with increasing academic attainment, while the reverse trend occurs in the case of colleges and universities. These trends may be explained by the following hypotheses:
 - (a) Physicists with bachelor's degrees know that industry wants them because of its recruiting efforts.
 - (b) These same physicists recognize that they are unlikely to obtain university positions.
 - (c) Physicists with bachelor's degrees may be presumed to prefer applied or development work, or to feel that they are only qualified for this type of work. The factors which led to their decisions not to do graduate work will operate to attract them to industry.
 - (d) Those physicists who have done some graduate work must be presumed, in general, to have more liking for the academic atmosphere and more scholarly interests than those with only bachelor's degrees. Having been longer immersed in the academic life and having better learned to subordinate materialistic goals, it is natural that more of those with graduate experience are attracted to university positions than to industrial positions.

This study indicates that:

1. Institutions, although somewhat unknown, attract a far larger proportion (28.2%) of physicists than they employ (3.9%).
2. Colleges and universities appear to be holding their own despite their lower salaries.
3. Since twice as many PhD's prefer university to industrial positions although they are willing to accept \$2000 per year less, industry might be able to attract more physicists, especially PhD's, by establishing a more academic atmosphere.
4. Establishment of a more academic atmosphere should help government attract more physicists. The problem, however, will not be completely solved by this step. The negative concepts associated with government employment must be reduced both in fact and in publicity.