

# PHYSICS and SOCIETY

## The NEWSLETTER of the FORUM on PHYSICS and SOCIETY

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LETTER: THE EQUAL RIGHTS AMENDMENT AND THE APS

Peter J. Gollom, Fermilab

To The Editor:

Recently the Solid State Division proposed to the APS Council that the APS not schedule any additional meetings in states which have not ratified the Equal Rights Amendment (ERA). I believe such a resolution deserves the full support of the Society and its membership. However, to be fully effective, the scope of that motion should be extended to include the cancellation and rescheduling elsewhere of meetings currently scheduled for states which have not ratified the ERA. For the APS to take these actions, the following questions must all be answered in the affirmative:

Is it appropriate for the APS to have a position on the ERA?

If so, should the APS support the ERA?

If so, is a refusal to meet in unratified states an appropriate tactic to use in furtherance of the Society's position on ERA?

Each of these questions shall be considered in turn.

*Is it appropriate for the APS to have a position on ERA?* It is clear from the existence of the Forum and POPA that some social and political issues are of concern to the Society. Although some of these issues are of concern because of their technical nature, others are of concern because of their effects on the careers of the Society's members, or because they in some way affect the Society's objective. The historical patterns of discrimination against women in education, employment, and other areas impedes the careers of women in physics, discourages many other talented women from entering the field, and retards the Society's goals of "the advancement and diffusion of the knowledge of physics".

The ERA is an attempt to remove many of the sex-discriminatory practices which have hampered, and continue to hamper women in their lives and careers. As such, it deals with a problem affecting the Society's members and goals, and is therefore a legitimate topic for consideration by the Society.

*Should the Society support the Equal Rights Amendment?* Clearly the answer is yes, since this amendment is the most sweeping single step which can be taken to eliminate existing patterns of discrimination against women. The Society's Committee on the Status of Women in Physics unanimously supports the ERA; so should the Society as a whole.

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## THE EQUAL RIGHTS AMENDMENT AND THE APS (continued from page 1)

*Is refusal to meet in unratified states an appropriate tactic to use?* The answer here is threefold: first, it is one of the few tactics the Society has at its disposal, other tactics being ineffective (letter-writing) or illegal (financial aid to pro-ERA groups). Second, it is an effective tactic: additional pressure is now being brought to bear on legislators in unratified states as a direct result of other groups refusing to meet in unratified states. Third, this is a just tactic: for years women have suffered economically as a result of discrimination. Those states which have not ratified the ERA are willing to perpetuate such discrimination. What could be more just, or more educational than for us to withhold our money from those areas of the country which would deny economic equality to their fellow citizens?

Finally, we come to the question of whether to simply not schedule any new meetings in unratified states, or to cancel already scheduled ones (e.g. Chicago in March, 1979). The former choice carries little risk, but its effect will not be felt until 1980 at the earliest. The latter choice carries more weight because its effect occurs a year or more earlier, and because the dollars lost because of a cancelled meeting appear more real than those lost because a meeting might have been scheduled somewhere but wasn't. Based on effectiveness, the choice is clear: cancel the meetings already scheduled.

The reasons for not doing so are two: the difficulty of rescheduling, and the legal liability of doing so. The former cannot be that difficult a problem, as other groups have already demonstrated. The AAAS cancelled its January 1979 Chicago meeting and rescheduled it with less than a year's lead time. The American Psychological Association is rescheduling three meetings, the largest of which normally attracts 15-20,000 registrants. If other groups can manage, so can we.

As far as the legal liability is concerned, I estimate the risk to be under \$5.00 per member, assuming the Society were actually to be sued by the Headquarter's Hotel and lose. This risk is small compared to the losses to the physics community resulting from sex-discrimination. Why shouldn't the Society put principle before finances and take as strong a position as possible: make our refusal to meet in unratified states apply to real as well as virtual meetings!

## PHYSICS AND SOCIETY

Editor:

MARTIN L. PERL

PHYSICS AND SOCIETY, the Newsletter of the Forum on Physics and Society of the American Physical Society is published for, and distributed free to, the members of the Forum. It presents news of the Forum and of the American Physical Society; and provides a medium for Forum members to exchange ideas. PHYSICS AND SOCIETY also presents articles, letters and columns on the scientific and economic health of the physics community; on the relations of physics and the physics community to government and to society, and

on the social responsibilities of science. Space is preferentially given to those analyses and opinions which are less likely to be published in the established journals such as Physics Today and Science. Letters, short articles, suggestions for columns, and Forum news item should be sent to the Editor.

PHYSICS AND SOCIETY is also distributed free to Physics Libraries upon request. Such requests and requests for other information should be sent to M. L. Perl.

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## THE FORUM INFORMATION AND INTRODUCTION SERVICE

Mary L. Shoaf, Forum Chairman

As one of its activities, the Forum will continue to serve as an information clearinghouse and to introduce members of the Society who share common interests in exploring science-and-society issues. The Forum will continue to organize invited and contributed paper sessions at the annual and general meetings of the Society which will provide opportunities for those who have worked together on a problem to apprise the rest of the physics community of their findings.

The Forum, as well as other Divisions and committees of the Society, has been encouraged to suggest topics suitable for development as conferences, APS summer studies, or publications to the Panel on Public Affairs (See POPA Guidelines, FORUM NEWSLETTER, page 5 of this issue; BAPS, February, 1978). The members of the Forum Executive Com-

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FORUM INFORMATION SERVICE (continued from page 3)

mittee hope that some of the projects begun by those whom the Forum has introduced will produce proposals to be submitted to POPA for consideration.

To discover whose interests are akin to your own, please send a letter or postcard to Dr. William Colglazier, Secretary-Treasurer, Forum on Physics and Society, Department of Physics and Astronomy, University of Montana, Missoula, Montana 59812.

Please list your name and address and describe your topic in twenty-five (25) words or less.

These notices will be published in a column in the next issue of the FORUM NEWSLETTER with an invitation to readers to contact the person submitting a notice.

The scope of the problem explored, the method of attack, the number of participants, and the nature of the product will have to be determined by those who decide to work together. The members of the Forum Executive Committee will provide help and advice whenever possible.

The only caution to be kept in mind by all is that none of this activity may be publicized, distributed, or presented by anyone using the name of the Forum or of the Society as an endorsement without having the explicit permission of the American Physical Society to do so. Permission is ordinarily given by the Council only upon the recommendation of the Panel on Public Affairs. The presentation of invited or contributed papers on these activities at appropriate meetings of the Society does not, however, require such review. The Society accepts all contributed papers from members or from authors sponsored by members which are submitted to it for presentation at meetings which reach the New York office by the deadline date for that meeting printed in the BULLETIN.

GUIDELINES FOR APS STUDIES AND POPA

The revised version of the Guidelines for APS Studies, reprinted below, was prepared by the members of the Panel on Physics Manpower and adopted by the Council during its meeting in Miami on 20 November 1977. Any member of the Society who is considering a project which would produce a document to be issued in the name of the Society or a subdivision of the Society should consult these Guidelines before preparing a proposal to POPA.

GUIDELINES FOR APS STUDIES

The American Physical Society has become increasingly involved in areas of knowledge that are the mutual and overlapping concerns of physics, physicists, and society. One need only consider the symposia on public affairs issues which were initiated by the Committee on Problems of Physics and Society (the precursor of the Forum), the symposia organized by the Forum and by the Society itself, the implementation of the Congressional Fellowship Program, the 1974 Topical Conference on Energy, the creation of the Panel on Public Affairs (POPA), and the completion of several summer studies concerned with energy. Through all these events, the Society has increased its involvement in public affairs: each activity has enhanced the potential for greater involvement by the members of the Society in such issues. These two complementary aspects must be clearly distinguished and both should be fostered. The Society, its members, and the public all profit from the development of mechanisms which can assist members in the exercise of their professional abilities in the public interest.

It is the intent of The American Physical Society to sponsor selected studies of matters which affect the general welfare to which physics can make important contributions.

Proposals for such APS studies will be reviewed first by POPA and, if recommended by that Panel, will be presented to the APS Council for authorization or rejection. Administrative oversight for a study will remain with POPA under the overall responsibility of Council, to which the final report of the study will be made.

1. Criteria for Acceptance

A proposal for a study should state its goals, how it plans to achieve them, and explain why The American Physical Society should lend its support to the study. Acceptance of a proposal will require favorable consideration of a variety of factors affecting the study and APS involvement in it. The following factors should be regarded as weighting factors - the stronger each can be established, the stronger the proposal.

A. Relevance to physics/physicists. There must be a contribution that physicists can make because of their training and experience as physicists. There must also be persuasive reasons why the APS should sponsor the study rather than another institution.

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B. Public Interest. The proposal should describe the extent to which the results will be important in the determination of public policy.

C. Need. There must be clearly perceived need for the results of the study, with a proposed path to utilization by a user agency(s), an institution, or the general public. One measure of need will be the extent to which the prospective user(s) will finance the study.

D. Contribution. There should be a high probability of making a useful contribution.

E. Timeliness.

F. Interdisciplinary Cooperation. Individuals from other concerned disciplines and from the user communities should be involved in the study ab initio.

G. Organization. The proposal should contain a complete plan for conducting the study covering the salient items of Part II below.

H. Publication. The final completed report of a study will be made available to the general public.

## II. Organization and Operation

Normally, the APS will be the contracting organization which will administer the study. Thus, the Society shall submit the proposal and see to it that the support funds are properly spent and that the objectives of the study are met. The release of the report shall not be subject to the approval of funding agencies.

The relation between the Society and the study it sponsors should not be forced into a single management form or style. However, proposals should address each of the following points. It will be appropriate for the author(s) to suggest individuals, list their qualifications, and their availability for each prospective position in the study.

### A. Management

1. Chairman. Each study will be headed by a Chairman appointed by POPA (with the approval of Council) with line responsibility to POPA. An Executive Assistant responsible to the Chairman may be needed to manage the administrative details and will be appointed by the Chairman with the approval of POPA.

2. Review Panel. Council will appoint a Review Panel to monitor the technical progress of each study, to review its conclusions, and to verify the technical soundness of the final report.

3. POPA. The Chairman of the Study and the Chairman of the Review Panel will maintain contact with the Chairman of POPA and inform him of the progress of the study. POPA will follow the content of the study with respect to the public policy issues involved and submit comments to the Study Group and the Review Panel.

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4. Timetable. In carrying out the study, it is desirable for the Study Group, Review Panel, and POPA to establish a timetable to insure that their individual functions are carried out effectively and thoroughly and that adequate time is allocated for presentation of the study to Council.

B. Financial Arrangements

A proposal should include estimated costs of the study, prospective external sources of support, and institutional arrangements for disbursements and accounting. Because of the Society's limited resources, direct financial support from APS will normally be small and of a "seed-money" nature.

C. Staffing

Full or part-time participants or consultants in a study will be appointed by POPA in consultation with the Chairman. A significant fraction of the study participants should be new to such studies as these. This will bring in fresh points of view, diffuse study experiences more widely, and establish a pool of experienced individuals who might be called upon in future studies. The proposal should also state where the study is to be conducted, list any arrangements made with the host institution, special facilities which might be required, and living arrangements.

D. Liaison

POPA will appoint someone, usually one of its members, to serve as a formal liaison between POPA and the study.

III. Study Report and Release

There shall be a final report transmitted by the Chairman, with the concurrence of the Review Panel, to POPA for comments. The Panel on Public Affairs and the Review Panel will then each recommend to the President and to the Council of The American Physical Society whether or not to authorize the release of the report for public distribution. In doing so, the Council attests that the study meets high standards of objectivity and addresses itself to the important public policy issues. This judgment is based on the integrity and competence of the Study Group, the Review Panel, and POPA, each performing their several functions.

The report shall be accompanied by a brief summary, stating the scope and principal conclusions of the study, in a form suitable for use as a press release.

Plans for the official release of the study shall be made jointly by the study group and POPA. Before Council has scheduled the final report for release as an APS-sponsored study, no reports or briefings concerning the results of an APS sponsored study shall be made by study members without prior approval of the Review Panel

It is to be expected that members of the study group will meet initially with sponsoring agencies to discuss the scope of the study.

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Under no circumstances should sponsoring agencies review, or appear to review, the content of the report during its preparation and before presentation to Council. After such presentation sponsoring agencies will be briefed, as requested, prior to public release. However, there should be agreement with them that no information released by them of any results should refer to an "APS sponsored study" until Council has scheduled the report for release.

IV. Procedure for Initiation of a Proposal

Proposals for studies should be submitted to the Executive Secretary of APS who will then notify the authors of Council's action. The authors should discuss the proposal with POPA before it is formally submitted.

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Letter To The Editor: Synergy Research Institute

Vladislav Bévc

I wish to bring to the attention of your readers the following announcement:

THE SYNERGY RESEARCH INSTITUTE -- SCIENTISTS' ECONOMIC DOCUMENTATION CENTER, a private foundation, collects and maintains records on violation of scientists' economic and human rights in the United States (Violations of Articles 22 and 23 of the Universal Declaration of Human Rights as published in the Bulletin of the American Physical Society, Series II, Vol. 21, No. 7, pp. 917-918, July/August 1976), i.e., the right to work in one's profession, to just and favorable conditions of work, and to protection against unemployment. These records are used in a sustained effort to remind the United States government of its failure to correct a chronic domestic problem and to provide references concerning the characteristics and background of organizations that employ scientists. All information is treated in accordance with the instructions of the contributors. Scientists who desire to send concise case histories or descriptions of adverse socio-economic conditions that are preventing them to work in their profession are invited to write to:

THE SYNERGY RESEARCH INSTITUTE  
SCIENTISTS' ECONOMIC DOCUMENTATION CENTER  
Box 561, San Ramon, California 94583



## ALTERNATIVE CAREERS FOR PHYSICISTS

Robert R. Trumble and Joan M. Mernin

National Science Foundation

## ABSTRACT

A number of key questions related to alternative careers for physicists are addressed. The major areas explored are Problem Identification, Related Factors, and Alternative Approaches. The components of these major areas are presented in terms of issues or questions: unemployment - As an indication of the present, what are the recent unemployment rates for physicists?; projections - Will there be an oversupply of physicists for traditional jobs?; academia - Since academic employment is vital to the labor market for physicists, what is the situation in this sector?; test scores - Do graduates in the physical sciences have the necessary quantitative and verbal skills to move into other fields?; continuing education - Are physicists willing to participate in continuing education in order to maintain or develop new skills?; job mobility - Where do graduates in physics presently find work and are they mobile?; and approaches - What are some of the partial solutions or options that could be considered concerning problems of academic employment? In conclusion, two other ongoing activities are mentioned.

## INTRODUCTION

Since policy and manpower specialists have evidenced interest in alternative careers for scientists. This is especially true in the academic arena where employment opportunities are very limited. The Manpower Studies Section of the National Science Foundation has highlighted the general issues and continues to provide information and analyses on the subject. Some of the salient issues or questions that collectively provide an overview are organized by problem identification, related factors, and alternative approaches.

## PROBLEM IDENTIFICATION

Unemployment

As an indication of the present, what are the recent unemployment rates for physicists?

Unemployment rates for scientists and engineers, and specifically physicists have been significantly lower than the rate for the total labor force. For instance, in 1974 the unemployment rates were 1 percent for physicists as well as for all other scientists and engineers (S&E's) versus 5.6 percent for the national total. Although there is a tendency toward higher unemployment rates for recent baccalaureates, recent physics graduates still maintain a somewhat lower rate than other fields. Physics baccalaureates of 1975 experienced a 7 percent unemployment rate,

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as opposed to 9 percent for all other physical sciences, more than 9 percent for mathematicians, and 14 percent for sociologists.

Projections

Will there be an over supply of physicists for traditional jobs?

While projections have not been done for all educational levels, recent Ph.D. projections for science and engineering fields based on two NSF models published in 1976 indicate that between 375,000 and 400,000 S&E doctorates will be available to the United States in 1985. Most fields within science and engineering will find an increasing supply of doctorates in the future, and overall projections indicate a trend toward increasing imbalances resulting in the supply of the Ph.D.s exceeding the number of traditional jobs. It is important to note that the comparison is to traditional jobs. Ph.D.s in the sciences will be all likelihood continue to have low unemployment rates but the issue is not unemployment but rather underemployment. Specifically, as doctorates move into new jobs will they be enriching the area and increasing productivity or simply reflecting underemployment? That is a key question that is presently under study. At any rate, as both supply and utilization increase through 1985, the increase in supply over utilization for Ph.D.'s is not expected to be as great for the physical sciences and life sciences as for the sciences in general. In apparent reaction to perceived employment problems in science and engineering, the difficulty in obtaining employment in their field, and other related factors, students in the past few years have been less apt to choose a major in physics. In addition, the college-age population (18-21 years) is approaching its peak and should start to decline after 1979. These trends are likely to continue through 1985, with increasing declines in faculty positions each year. Due to the substantial number of physicists dependent on academia for employment, decreases in the number of faculty positions available have adversely affected employment opportunities for physicists and will continue to do so.

Incidentally, the difficulties that are foreseen with traditional employment of Ph.D.'s is not limited to the United States. Related concerns have been expressed in Canada. For instance, Max von Zur-Muehlen the Coordinator of Research in the Institutional and Public Finance Statistics Branch of the Canadian Government has written on "The Ph.D. Dilemma in Canada Revisited" and "The Canadian Universities in a Crisis." In the past there was some tendency for the U.S. doctorates to find traditional employment--specifically academic positions--in Canada. This is, of course, increasingly unlikely.

Academia

Since academic employment is vital to the labor market for physicists, what is the situation in this sector?

The "lockout" of young scientists and engineers on college faculties is a basic problem facing the scientific community today. Since more than

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half of all basic research in the United States is performed by university faculties, this "lockout" is threatening the vitality of important university-based research and the maintenance of a diverse high-quality Ph.D. faculty. With little choice but to look for employment in other areas, many recent physics graduates and graduates in science and engineering in general, have found employment in areas outside the educational sector and outside their respective field.

The declining enrollments in physics and the resultant decrease in the number of faculty positions had had an affect on tenured versus non-tenured faculty ratios. The physical sciences are expected to encounter the greater difficulties, with remarkable decreases in student enrollments and available faculty positions until 1985. The sciences and engineering have already experienced a 70 percent increase in the proportion of tenured faculty in recent years. The increase for tenured physics professors was slightly higher. Accompanying this increase in tenured S&E faculty members has been a significant increase in the median age of faculty members. Together these trends are likely to restrict the opportunities for young professors in the sciences and engineering.

## RELATED FACTORS

Test Scores

Do graduates in the physical sciences have the necessary quantitative and verbal skills to move into other fields?

With such a significant amount of job mobility exhibited by recent physics, Graduate Record Examination scores may be some indicator of the ability of physical scientists, relative to other graduates. The GRE scores for the physical science fields fluctuated very little from 1970-71 to 1974-75. The mean verbal score of 512 in 1970-71 decreased slightly to 508 in 1974-75, but remained well within the standard deviation for either estimate. In both the verbal score and the quantitative score, prospective graduate students in the physical sciences remained near the top. As a matter of fact, both the relative and absolute scores have remained fairly constant over the five year period for all fields tested. The high scores of graduates in the physical sciences suggests the ability to be employed successfully in various fields.

Continuing Education

Are physicists willing to participate in continuing education in order to maintain or develop new skills?

In 1972 the National Science Foundation and the Bureau of the Census developed the National Sample of scientists and engineers who represented the 1.4 million individuals considered to be scientists and engineers at the time of the 1970 Census of Population. Although the National Sample represents a mature group of scientists and engineers; the data indicate substantial interest in continuing education, both formal and nonformal.

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Between one-fifth and one-fourth of the physicists in the National Sample received nonformal training in every year, 1972 through 1975. These data indicate there is a propensity on the part of scientists and engineers in the National Sample to maintain or upgrade their technical competence.

Job Mobility

Where do graduates in physics presently find work and are they mobile?

Individuals earning a bachelor's degree in physics during 1975 and entering the labor force numbered 2,900, yielding a labor force participation rate of 78 percent. (The bulk of the remaining 800 graduates went on to graduate school.) Although fewer than 40 percent of these baccalaureates were employed in the physics area, about three-fourths were employed in S&E. Compared with the 40 percent of 1975 S&E baccalaureates employed in science and engineering, this high percentage may be partially explained by the significant number (20%) of physics baccalaureates finding employment in engineering. Due to the notable proportion of physics graduates working in the field of engineering, it would appear that individuals trained in physics are not necessarily more versatile; rather, there is a cross-training relationship between the two fields. The retention rate for all other physical sciences was slightly over 40 percent, whereas only 54 percent were employed in science and engineering. Sociologists had an expected, considerably lower retention rate of almost 12 percent with only 20 percent of those receiving a bachelor's degree in sociology in 1975 employed in science and engineering. Data from 1974 reveal comparable rates for similar baccalaureates.

Eighty percent of the 1975 master graduates in physics were employed in science and engineering. While 40 percent of the physics graduates entered the field of physics, almost that many entered the engineering field. Thus, again a large portion of the outbound physics graduates turned to engineering for employment. The field mobility of doctoral physicists exemplifies the situation for all recent physics graduates. ~~Physics~~, as well as chemistry, has lost a substantial portion of its doctoral population to other fields. In 1973, the retention rate of Ph.D. physics graduates was the lowest at 71 percent, with the next lowest rate in chemistry. Factors that could contribute to such attrition are job opportunities or lack thereof, and the possibility that individuals trained in these disciplines have diversified skills such that they are more employable across broad fields. Almost one-third of physics doctorates were employed in fields other than physics, while only a small number (14 percent) of the individuals employed in physics earned doctorates in other fields. Studies of Ph.D. labor force mobility indicate that other than their own fields, the largest percentage of physicists are found in engineering and vice-versa for engineers. Since the vast majority of jobs in engineering are located in business and industry rather than education, and this employment sector is not experiencing the significant decrease in available jobs occurring in education and government, the movement of large numbers of physics graduates into the field of engineering is expected to avoid a high percentage of employment outside

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S&E. This entrance into engineering kept the percentage of physics graduates employed in overall S&E equal to or greater than most other fields.

## ALTERNATIVE APPROACHES

Approaches

What are some of the partial solutions or options that could be considered concerning problems of academic employment?

Since demographic factors in years to come are expected to hinder the efforts of young doctors desiring to enter the education sector of science and engineering, new opportunities within or outside the academic field must be explored. Dr. Richard Atkinson in a recent issue of the Chronicle of Higher Education outlined a few ideas presently being explored which include: "early retirement through a program to assist faculty members to enter a second career (Contributions by the government to retirement plans might remove some of the financial risk involved in such a venture); a program of senior research scientist grants to universities, which would allow (older) faculty members to spend more time in research and make money available to hire (younger) scientists for teaching assignments; and industrial investment, possible into a university-based research institute, to involve (senior) faculty more fully in basic research."

The idea of mid-career shifts and retraining by faculty members for various motives would make room for young Ph.D.'s and is becoming more widely acknowledged. These faculty members would probably embark on a second career well before retirement age. However, there are obstacles to such a shift. Most faculty retirement plans do not allow for such an early retirement by its members, and to keep their retirement plans active, contributions to the plan must continue until actual retirement age is reached.

The **government** could possibly introduce an incentive program for faculty members who are willing to start a second career by contributing a portion of the funds necessary to maintain a professor's retirement plan. There could be some problems instituting such a program to insure equal opportunities for all faculty members. Thus, additional approaches for making mid-career shifts more attractive to senior faculty members should be considered.

Another program that might permit a tenured faculty member to devote more time to research, while remaining on a university faculty, would be Senior Research Scientific Grants for productive scientists. The grant would stipulate that the university use the money from the salary no longer needed for the tenured professor to hire a young faculty member who would assume the teaching load of the senior scientist.

A third option might be to create research institutes that would be partially supported by industry in return for satisfying some basic-research needs of our major industries. Presumably, these research institutes would still be under university control.

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In addition to these options there are other alternatives. For instance, there are a number of opportunities for professors on leaves of absence, to try new kinds of work with different organizations. Although the programs which sponsor such activities are not primarily concerned with career change, a substantial minority of these professors do decide to remain with the new organization outside the academic world. Conducting a study related to career changes by tenured faculty members, Abt Associates found the main obstacle to the encouragement of this program lies in the minimal control over professors chosen for such grants. It is likely that the selection criteria employed actually would not benefit most colleges and universities. These programs tend to select the most productive faculty members, whereas academic institutions would prefer to encourage career change among the least productive faculty members. Another recent development related to the problems facing academic institutions, deals with the retraining of faculty members involved in certain academic programs that are expected to be abolished or curtailed. Hopefully, in this way, commitments to faculty members can be fulfilled by retraining them for work in appropriate new fields. Though not exactly a career-change program, this alternative would allow institutions to reallocate human resources, and thus, is being considered by several institutions.

Finally, part-time employment is a flexible alternative that could be used in conjunction with a number of the approaches mentioned. Part-time faculty appointments with joint positions in industry could be considered. Part-time employment could also be a mechanism, that would partially resolve the economic problems of the individual and the loss of key skills by the institution related to early retirement.

Ongoing Activity

Later in the year it is anticipated that the Higher Education Research Institute will analyze data which they collected concerning non-traditional employment for doctoral scientists and engineers. The thrust of this study, funded by the Manpower Studies Section at NSF, is to determine the magnitude, directions, and factors related to employment of Ph.D. scientists and engineers in areas not normally associated with their respective fields.

In early August the Science Education Directorate held a conference in Washington on Continuing Education related to mid-career transitions. This conference, as well as the Abt Study and the Higher Education Research institute report should shed new light on approaches to the problems relating to university-based research and the "lockout" of young doctorates from science and engineering faculties.

(This paper was presented at the Conference on Changing Career Opportunities for Physicists, Pennsylvania State University, August, 1977)

## LETTER: THE PHYSICS EMPLOYMENT PROBLEM

Robert J. Yaes  
 Memorial University of New Foundland

To The Editor:

I am afraid that the letters\* of Wayne Saslow and Lincoln Wolfenstein are much more typical of the attitude of most senior physicists to the employment problem than Martin Perl's editorial on the subject. Dr. Saslow's letter could be summed up as saying "cutbacks in graduate enrollments should be made, but at your institution, not mine". Needless to say, if everyone takes this attitude, there will be no cutbacks made at all. Dr. Saslow also assumes that there is an excess of unfilled jobs for physicists in industry yet, available evidence seems to indicate that the opposite is, in fact true. According to a recent NSF report, the total number of scientists and engineers employed in private industry in the U.S. actually dropped by 5% between 1970 and 1975

Perhaps one can understand Dr. Wolfenstein's insensitivity to the problem by the fact that he belongs to a generation of physicists who never had to worry about employment (20 or 30 years ago, you might not get a job at Harvard or Princeton, but you could always get a job). The person in the worst situation is not the person who cannot find a job on graduation, but the physicist who gets several postdocs in succession and then cannot get another or the person who lands a teaching position and then six years or so later is denied tenure. He is likely to be in his mid thirties, have family responsibilities and thus little savings, have spent all of his working career in one very highly specialized area (like particle theory) and thus be virtually unemployable. According to a recent APS survey, assistant professors at elite institutions who are denied tenure are likely to find positions at less prestigious institutions, where they will complain endlessly about the quality of students and the size of the teaching load. However, one might assume that physicists denied tenure at these less prestigious institutions which the APS didn't bother to study are likely to be unable to find another job at all. Needless to say, it would be much easier and less painful for a person to change his career if denied admission to a graduate program at age 22 than when denied tenure at 35.

I imagine that it is easy to casually discuss the "hurdles" that one must pass on the road to a research career, for one who passed them when they were low. One might, however, expect a little more concern for those who fall on their faces, now that those hurdles have become virtually insurmountable. Dr. Wolfenstein cannot be unaware of the **fact**, that in his **own** specialty of elementary particle theory there are so few new tenure track academic positions opening per year that you could probably count them all on the fingers of one hand and have fingers left over. He must also know that "educated people" are already lobbying extensively to influence political decisions. While such lobbying has been remarkably effective in producing funding for capital-intensive projects like PEP, LAMPF, ISABELLE and the Fermilab energy doubler, it does not seem to have produced many additional jobs for physicists. Physicists who claim that "all our students get jobs" are obviously not interested in following what happens to these students after their first postdoc.

It is time for tenured university physicists to pull their heads out of the sand and come to terms with the real world. One can already see the best students turning their backs on Physics to study Engineering, Law and Medicine where their employment prospects are reasonable and where the faculty demonstrates some interest in their future. The attitude displayed by Saslow and Wolfenstein can only accelerate this trend.

\*See Physics and Society Vol. 7, No. 1 (1978)

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