

APPENDIX VI

REPORT OF THE NATIONAL SCIENCE FOUNDATION—AMHERST CONFERENCE ON PHYSICS RESEARCH IN COLLEGES

I. Purpose

On May 4–6, 1953, a conference was held at Amherst College to discuss the status of physics research in colleges. The conference was jointly sponsored by Amherst College and the National Science Foundation. A committee under the chairmanship of T. Soller directed the meeting. The committee was composed of the following members:

THEODORE SOLLER, Amherst College,
Chairman.

WALTER C. MICHELS, Bryn Mawr College.

KARL S. VAN DYKE, Wesleyan University,
Connecticut.

MILDRED ALLEN, Mount Holyoke College.

CHARLES A. FOWLER, Pomona College.

R. RONALD PALMER, Beloit College.

J. HOWARD McMILLEN, National Science
Foundation.

Twenty-five college teachers of physics with an active interest in physics research were assembled. They were chosen so as to represent various types of colleges and regions of the country.¹

II. Major Recommendations

The conferees agree that the instruction and intellectual development of students is the fundamental task of college teachers. They conclude, nevertheless, that this task not only is entirely compatible with the simultaneous pursuit of scientific research, but also that it is greatly aided thereby.

The liberal arts colleges of this country can make significant contributions to the national output of research; this activity will benefit both the teacher and the students, it can aid in attracting able young scientists into college teaching and generally raise the scientific maturity of our college communities.

The undergraduate colleges have played

a major role in the development of physics in the United States, both by the research carried on in their laboratories and through the early training of a large proportion of working physicists. During the postwar expansion of research facilities, the potentialities of many colleges have been neglected by the granting and contracting agencies of the Federal government, by industry and by the colleges themselves. This conference believes that it would be in the national interest to correct this situation.

The conference discussed the problems which would arise in administering a grant program and in evaluating requests for grants. It also discussed the advantages and the dangers of the program, from the point of view of colleges which must consider education to be their prime objective. Following this discussion *the conference makes the following recommendations:*

1. THE FEDERAL GOVERNMENT, THROUGH APPROPRIATE AGENCIES, SHOULD ESTABLISH A SPECIAL PROGRAM FOR AWARDING GRANTS OR CONTRACTS FOR THE ENCOURAGEMENT OF PHYSICS RESEARCH IN COLLEGES NOT CONNECTED WITH LARGE GRADUATE SCHOOLS.
2. GRANTS OR CONTRACTS AWARDED UNDER THIS PROGRAM SHOULD HAVE AS PRIMARY OBJECTIVES BOTH THE ENCOURAGEMENT OF SIGNIFICANT RESEARCH, AND THE IMPROVEMENT OF THE EDUCATION OF PHYSICISTS WHO WILL BE AVAILABLE TO STRENGTHEN SCIENCE IN THE UNITED STATES.

¹ The list of those attending the conference is contained at the end of the report.

III. Benefits of Grant Program

The conference calls attention to the following advantages and benefits to result from the recommended program. In assessing the benefits of research in colleges to the national research program, attention should be given not only to the published results of these efforts but also to their effect on increasing the number and quality of physics majors that the colleges furnish to our graduate schools. This should enhance the level of sciences throughout the country. While this section outlines the potentialities of research in small colleges, an adequate program of research is not possible at the present time because of financial limitations.

Contributions to Scientific Knowledge. The national output of research can be enhanced by the contributions of the colleges.

- (a) The output of the colleges can in the aggregate be large because of the large number of physicists involved.
- (b) Physicists in the small colleges and in the large university have received the same training and both can make contributions despite the larger teaching load of the former.
- (c) Research in small colleges can advance the frontiers of science.
- (d) Important basic research can even today be carried out by individuals; neither large teams nor large budgets are a vital necessity for the making of significant contributions.

Advantages of the Small College for Research. There are definite advantages of the small colleges as a place for some types of basic research:

- (a) The opportunity for the individual's independent choice of problem and of line of attack can be more easily provided for in small colleges.
- (b) The administrative procedure is usually simplified.
- (c) The pressure for results is usually less and consequently there should be more time for contemplation of problems.

Benefits to the Faculty Member. The individual faculty member derives substantial

benefit from such a research program in the following manner:

- (a) His research should be a continued stimulus to his intellectual growth.
- (b) His research offers one of the best means of broadening the scientific basis from which his fundamental work of teaching proceeds. This assumes that administrative arrangements permit an adequate allocation of time for the teaching function while research is pursued.
- (c) His professional prestige, his independence, and his self-esteem are enhanced, as he continues to be a creative physicist.
- (d) His income may be increased by regular summer employment.

Benefits to Students. Students in a department which is actively engaged in research may realize the following benefits:

- (a) The active work of professors is reflected in more vital teaching.
- (b) The student's concept of the science and of its importance is made more realistic by this contact with creative work.
- (c) Students may participate directly in research at an earlier stage in their development than is usually possible in a university.
- (d) Senior projects or theses may be related to the larger program, and may be significant contributions in themselves.
- (e) Part-time remuneration for research assistance is sometimes available.
- (f) Undergraduate research experience leads to better graduate school opportunities.

Benefits to the Colleges. The colleges will benefit from research in a number of ways:

- (a) They will be able to attract and to hold better qualified men as physics teachers if their continued research activity is made practicable.
- (b) Student participation in research will stimulate the better students and attract more good students, thus improving the quality and the number of physics majors.
- (c) The intellectual development of the faculty members will lead to better

teaching and hence to a better college.

- (d) The publication of the results of research will have prestige value to the college.
- (e) The continuance of the research activity of the younger teacher fresh from graduate school may provide a means for revitalizing in research and in the live science the older teacher whose contacts with the changing fields of physics have become second hand.

IV. Kinds of Research Suitable to Colleges

Inasmuch as almost any type of research in which a college teacher is sincerely interested and well qualified can contribute to the dual objectives of contribution to scientific knowledge and contribution to the educational work of the institution, the conference considers it unwise to prescribe limitations as to particular research fields. However, there are certain criteria which seem applicable to the selection of suitable problems for the typical small colleges. The more important factors include:

- (1) The investigator should have experience that is relevant to the project proposed.
- (2) The research should be of such a nature as to allow understanding participation by serious undergraduate students.
- (3) The project should have modest equipment and space requirements. In the event that little or no capital equipment is available, the investigator should endeavor to keep the equipment requirements within reason.
- (4) The small college is in a particularly favorable position to make a significant contribution in certain areas which are better suited to individual and independent research than to large projects existing in the universities.

Some additional considerations of lesser importance may enter into the choice of a research problem:

- (1) It is often wise to choose a field of investigation that is not too fast-moving or competitive, since full-time effort toward research, except during the summer, is rarely possible for the college teacher.
- (2) Where possible, it would seem desirable that two or more members of a department collaborate on a single project.
- (3) Problems which combine the efforts of scientists in more than one field should be encouraged.

Some of the areas in which small colleges are at present doing significant work (under grants from NSF, ONR, AEC, OOR, OSR, Research Corp., etc.) include: (a) solid state, especially semi-conductors, magnetism, and thin-film studies; (b) high energy particle study, especially investigations using nuclear emulsions; (c) gas and spark discharge experiments; (d) certain areas of electronics, such as transistor circuit development, and (e) important work in optics, thermodynamics, acoustics, electrodynamics, and other fields of fundamental physics which have been neglected in favor of more exciting frontier fields.

Examples of current projects are illustrative of several patterns which have been successful in small colleges. At one college, a photosynthesis project supported by a private foundation involves the cooperation of staff and students from the chemistry, physics, and biology departments. At another, each of the five physics teachers is working half-time on research. At still another college, three teachers are working cooperatively on low-temperature research. A fourth pattern is represented by a recent program calling for collaboration between individuals in different colleges and a group in a large research center.

V. Most Suitable Grants Program

The discussion during the conference indicated that a wide variety of needs exists in the colleges. The previously outlined objectives can be achieved best if the program is a very flexible one. Grants should generally make provision for financial assistance to the faculty member and to the

college as well as for equipment, supplies, travel, technical assistance, etc.

The conference recommends that this assistance be accomplished by grants of the type in which the payment of summer salary is made, by grants permitting an occasional provision of a year free of teaching assignments, or by grants which relieve a small part (generally not greater than one-third) of the faculty member's formal teaching load during the year.

THE CONFERENCE RECOMMENDS THAT SPECIAL ADVISORY PANELS BE USED TO ASSIST IN THE ADMINISTRATION OF PROGRAMS OF THIS KIND.

Such panels should consist of individuals each of whom has the following qualifications:

- (1) He shall have contributed to the progress of physics through his research.
- (2) He shall have demonstrated superior ability as a teacher at the undergraduate level.
- (3) He shall be acquainted through present or recent association with institutions of the type involved in the program.

Grants or contracts should be made under this program only when it appears probable that the project will be significant for its own sake and that it will contribute to the educational work of the institution. It is suggested that the advisory panels in evaluating proposals, take into account some or all of the following considerations:

- (1) Projects which involve student participation should be strongly encouraged.
- (2) The promise and ability of the principal investigator should be given weight at least equal to that assigned to the scientific merit of project.
- (3) An attitude sympathetic to research in the department and in the institution is highly desirable.
- (4) The value of the research may be judged after consultation with experts in the field, but these experts should be cognizant of the fact that they are judging proposals under the college program.

Because of small administrative staffs in colleges, the conference recommends that administrative procedures connected with such grants be kept to a minimum.

VI. The Problem of Stimulation to the College Research Worker

A serious handicap to the progress of a college research program is the isolation of many college investigators. The awarding of a grant or contract in itself tends to reduce this isolation. Factors which may be helpful in overcoming the effects of isolation are the following:

- (1) In certain cases advice of an expert may be helpful in getting research started.
- (2) Arrangements may be made for consultations during the course of a project with experts in the field of the research undertaken.
- (3) Grants may include provision for travel expense for attending scientific meetings and for visiting other laboratories.
- (4) Grants may be provided for occasional summer work at other institutions. Industries should be encouraged to support summer projects.
- (5) Leaves of absence help relieve isolation.
- (6) Group efforts of the various sorts mentioned in the previous section promote a stimulating exchange of ideas.
- (7) The informal exchange of prepublication results among various investigators in a field is recommended.

VII. Non-Federal Support for Research in Colleges

The conference recognizes the importance of the encouragement of basic physics research by private, industrial, and other nongovernmental groups. *It is recommended that college administrators actively solicit aid from such sources under conditions that will maintain the coordination between research and teaching that has been emphasized above.*

It is further recommended that the American Association of Physics Teachers set up a com-

mittee which, working in cooperation with the American Institute of Physics, will investigate ways and means of promoting the support of basic physics research in colleges.

Appendix

Participants in the conference are listed below. The number was limited to 25 in order to give adequate representation without endangering the efficiency of the operations of the conference. The sponsors realize that many colleges of recognized achievement in the research and education field were not included in the conference; unfortunately the limitation of conferees to 25 made this unavoidable. It was felt, however, that the participants, chosen as they were from so many different types of colleges, truly represented the cross section of physicists in American colleges.

MILDRED ALLEN, Mount Holyoke College, Mass.

IAN G. BARBOUR, Kalamazoo College, Mich.

LAURENCE R. BICKFORD, New York College of Ceramics, N. Y.

P. E. BOUCHER, Colorado College, Colo.

W. W. DOLAN, Linfield College, Oreg.

W. C. ELMORE, Swarthmore College, Pa.

CHARLES A. FOWLER, Pomona College, Calif.

GRANT O. GALE, Grinnell College Iowa.

THOMAS E. GILMER, Hampden-Sydney College, Va.

LORENZ D. HUFF, Clemson, S. C.

HAROLD C. JENSEN, Lake Forest College, Ill.

THURSTON E. MANNING, Oberlin College, Ohio.

WALTER C. MICHELS, Bryn Mawr College, Pa.

DOROTHY D. MONTGOMERY, Hollins College, Va.

GWILYM E. OWEN, Antioch College, Ohio.

R. RONALD PALMER, Beloit College, Wis.

WILLIAM L. PARKER, Reed College, Oreg.

PAUL B. PICKAR, Loyola University, La.

THEODORE SOLLER, Amherst College, Mass.

REGINALD J. STEPHENSON, Wooster College, Ohio.

T. H. TAYLOR, Morgan State College, Md.

FRANCIS E. THROW, Wabash College, Ind.

FRANK VERBRUGGE, Carleton College, Minn.

KARL S. VAN DYKE, Wesleyan University, Conn.

JOHN XAN, Howard College, Ala.