References

1. ADELMAN, FRANK L. and JONES, STANLEY B. *Science,* 1950 to be published.
2. ALVAREZ, L. W. *et al. Bull. Amer. phys. Soc.,* 1949, **24**, 20.
3. BARKAS, W. H. *Bull. Amer. phys. Soc.,* 1949, **24**, 13.
4. BJORKLUND, R. *et al. Phys. Rev.,* 1950, **77**, 213.
5. BLAU, M., WAMBACHER, H. *Nature,* Lond., 1937, **140**, 585.
6. BRADNER, H. *et al. Phys. Rev.,* to be published.
7. BRODE, R. B. *Rev. mod. Phys.,* 1949, **21**, 37.
8. BURFENING, J., GARDNER, E., and LATTES, C. M. G. *Phys. Rev.,* 1949, **75**, 382.
9. CHANG, W. Y. *Rev. mod. Phys.,* 1949, **21**, 166.
10. DEMERS, PIERRE. *Science,* 1949, **110**, 380.
11. FUJIMOTO, Y., HAYAKAWA, S., and YAMAGUCHI, Y. *Prog. Theo. Physics,* in press.
12. GARDNER, E. and LATTES, C. M. G. *Science,* 1948, **107**, 270.
13. HARTSOUGH, W., HAYWARD, E., and POWELL, W. M. *Phys. Rev.,* 1949, **75**, 905.
14. JONES, S. B. and WHITE, R. S. *Phys. Rev.,* in press.
15. KAPLON, M. F., PETERS, B., and BRADT, H. L. *Phys. Rev.,* 1949, **76**, 1735.
16. KELLER, JOSEPH M. *Amer. J. Phys.,* 1949, **17**, 356.
17. LATTES, C. M. G., OCCHIALINI, P. S., and POWELL, C. F. *Nature,* Lond., 1947, **160**, 453, 486.
18. LEIGHTON, R. B., ANDERSON, C. D., and SERIFF, A. J. *Phys. Rev.,* 1949, **75**, 1432.
19. MARSHAK, R. E. *Phys. Rev.,* 1949, **76**, 1736.
20. ———. Echo Lake Cosmic Ray Conference, June 22–28, 1949.
21. MARTINELLI, E. and PANOFSKY, W. *Phys. Rev.,* to be published.
22. MCMILLAN, E. M., PETERSON, J., and WHITE, R. S. *Science,* 1949, **110**, 579.
23. NEREson, N. and ROSSI, B. *Phys. Rev.,* 1943, **64**, 199.
24. PERKINS, D. H. *Phil. Mag.,* 1949, **11**, 601.
25. POWELL, C. F. *et al. J. sci. Instr.,* 1946, **23**, 102.
26. POWELL, C. F. and OCCHIALINI, G. P. S. *Nuclear physics in photographs.* Oxford: Clarendon Press, 1947.
27. RICHARDSON, J. R. *Phys. Rev.,* 1948, **74**, 1720.
28. SHAPIRO, M. M. *Rev. mod. Phys.,* 1941, **13**, 58.
29. SMITH, F. M. *et al. Bull. Amer. phys. Soc.,* 1949, **24**, 9.
30. STEINBERGER, J. and BISHOP, A. S. *Bull. Amer. phys. Soc.,* 1950, **25**, 11.
31. TIOMNO, J. and WHEELER, JOHN A. *Amer. Sci.,* 1949, **37**, 202, 417.
32. YAGODA, H. *Radioactive measurements with nuclear emulsions.* New York: John Wiley and Sons, 1949.
33. YUKAWA, H. *Proc. phys. math. Soc. Japan,* 1935, **17**, 48.

The Cooperative Committee for the Teaching of Science:[1] A Report to the AAAS Council, December, 1949

K. Lark-Horovitz

Purdue University, Lafayette, Indiana

A SMALL DELIBERATIVE COMMITTEE was set up in 1941, sponsored by five scientific societies representing biology, chemistry, mathematics, physics, and research in science teaching,[2] to consider problems of science in general education that no single organization can solve alone. The committee is known as the Cooperative Committee on Science Teaching. Most of its original members were members of college or university faculties, and their affiliations were with learned societies. In general, the committee represented the point of view of college and university men on problems of science in general education. There were also members working on the secondary school level, but

[1] Present membership: American Association of Physics Teachers (K. Lark-Horovitz, Purdue University, Glen W Warner, Lakeville, Indiana); American Astronomical Society (Ralph C. Huffer, Beloit College); American Chemical Society (C. H. Sorum, University of Wisconsin); American Institute of Physics (K. Lark-Horovitz, Purdue University); American Society of Zoologists (L. V. Domm, University of Chicago); Botanical Society of America (Glenn W. Blaydes, Ohio State University); Central Ass'n. of Science and Math. Teachers (Arthur O. Baker, Cleveland Board of Education); Division of Chemical Education of the American Chemical Society (Laurence L. Quill, Michigan State College); Executive Committee of the AAAS (E. C. Stakman, University of Minnesota); Geological Society of America; Mathematical Association of America (Raleigh Schorling, University of Michigan); National Association of Biology Teachers (Prevo L. Whitaker, Indiana University); National Association for Research in Science Teaching (George Mallinson, Western Michigan College of Education); National Council of Teachers of Mathematics (J. R. Mayor, University of Wisconsin); National Science Teachers Association (Morris Meister, Bronx High School of Science); Section Q. Education, AAAS (B. L. Dodds, Purdue University); U. S. Office of Education (Bernard B. Watson, U. S. Office of Education). Chairman, K. Lark-Horovitz, Physics Department, Purdue University. Secretary, R. W. Lefler, Physics Department, Purdue University.

[2] American Association of Physics Teachers (K. Lark-Horovitz, Purdue University, Glen W. Warner, Wilson Junior College, Chicago); American Chemical Society (B. S. Hopkins, University of Illinois, Martin V. McGill, Lorain High School, Lorain, Ohio); Mathematical Association of America (A. A. Bennett, Brown University, Raleigh Schorling, University of Michigan); National Association for Research in Science Teaching (G. P. Cahoon, Ohio State University, Robert J. Havighurst, University of Chicago); Union of Biological Societies (Oscar Riddle, Carnegie Station for Experimental Evolution, Walter F. Loehwing, State University of Iowa); Robert J. Havighurst, chairman; Glen W. Warner, secretary.

they were in the minority. Financed by a small grant from the Carnegie Foundation, the committee considered primarily four problems. They were: (1) licensing or certification of secondary school science teachers; (2) college training of prospective science teachers; (3) exploratory studies of the secondary school science curriculum; and (4) curriculum projects in the state of Indiana.

In 1944, with the expiration of the Carnegie Foundation grant, the committee decided to reorganize on a new basis, with a new and expanded membership. Representatives from geology, astronomy, and applied biological fields (agriculture), as well as some of the secondary school teachers' organizations, were considered, and the committee asked the Executive Committee of the AAAS to appoint it as an agency of the Association. In this proposal (February 1945) the committee, formulating its plans and functions, pointed out that as such an agency it could give the sections of the Association and their affiliated societies a chance to coordinate their interest in science education. It could bring the Association to the attention of science teachers. And it could help to arrange public meetings at the time of the AAAS meetings, designed to draw a large attendance of teachers from the area in which the meeting is held, and help the Association to make an appeal to teachers, as the British Association has done so successfully.

The committee also pointed out that it could provide a forum in which representatives of scientific societies could state the views of their own groups and learn about the views of other groups on science teaching. It could serve its parent organization as a clearinghouse for information, and as a source of stimulation with reference to science education, and report to it regularly through its representatives on the committee. It would also be in a position to work cooperatively, upon request, with other organizations.

As to representation, the committee suggested that it should judge its own needs for new members and follow in general the principle that the number of representatives in a given science area would not exceed three. Membership would be from 15 to 20. The principle of such representation is not to protect interests but to insure an adequate representation of various points of view. The parent organization would name the representative for terms of several years, the exact term to be decided by the organization. This would result in a fair degree of continuity of membership without too much rigidity. The parent organization would be expected to select as representatives persons who had shown special interest in science education, both elementary and secondary.

The committee would organize itself, electing its own officers, to insure its continuous activity. However, the Executive Secretary of the AAAS would have the power to call a meeting of the committee whenever a year passed without the committee's having met. The parent organization should provide for the travel expenses of its own representatives who attended the committee meeting. The small overhead expenses for incidentals should be cared for from other sources—possibly the institution with which the chairman is associated.

In case the committee should engage in projects requiring money for research or publications, such funds should be solicited explicitly for the project alone. Thus the parent organization would not be obligated beyond providing for the attendance at the meeting of its own representatives. Ordinarily the committee would be expected to meet twice a year, one meeting to coincide with the annual meeting of the AAAS, facilitating contact of the committee with the parent organization. Thus one meeting at a time, relatively free from conflict with other meetings, would permit intensive work by committee members.

The committee, as a working group, would need continuity of attendance. The parent organization should consider this in naming representatives.

When the committee's proposal was received, Otis W. Caldwell was chairman of a Committee for the AAAS on The Place of Science in Education, and as a consequence, the negotiations for the reorganization of the committee were carried on primarily through Dr. Caldwell and E. C. Stakman, as representing the AAAS Executive Committee. The discussions of the Executive Committee in the late fall of 1944 had indicated the interest of the Association in the type of work the committee was engaged in. As to the organization, a very liberal attitude was taken:

> Attention was called to the fact that several members of the Committee are not members of the AAAS. That is not essential to our cooperation. We should welcome all of them as members if they care to join the Association. Please understand that we shall cooperate regardless of whether the members of the Committee are members of AAAS.[3]

The proposal was accepted by the Executive Committee of the AAAS in March, 1945 and it was moved that there be appointed a AAAS Cooperative Committee on the Teaching of Science. The motion included a request that in the reorganization at least half of the old committee should continue for at least one year on the new committee, in order to set up plans and guide those plans in terms of the lines of procedure already engaged in.

The Executive Committee expressed very definitely the thought that it was best to have the new organization appointed as a committee of the AAAS, not

[3] Letter of Dr. Caldwell to R. J. Havighurst, then chairman of the committee.

raising the question of the precise nature of affiliation or association.

It is of interest to note that as early as 1944, the Committee on the Professional Training of Chemists had recommended that "all of the societies' efforts to improve the teaching of chemistry in secondary schools be limited to the Cooperative Committee, and such central agencies as have been chosen by the Cooperative Committee."[4]

The Bibliography by the Cooperative Committee Reports gives an outline of the committee's activities. It has fulfilled its function to provide a forum for the discussion of science teaching, starting with the St. Louis meeting of the AAAS, and has repeated these forums at consecutive meetings of the Association.

In 1946, the committee joined in an effort with a committee of the National Science Teachers Association to report on science course content and teaching apparatus used in U. S. schools and colleges. This report was submitted to the ministers of education of the devastated countries of the United Nations. The Cooperative Committee prepared the college material and participated in an advisory capacity in the preparation of the entire report.

The committee undertook its biggest task in participating in the report by the President's Scientific Research Board, "On the Present Effectiveness of Our Schools in the Training of Scientists." This report appeared in Vol. 4 of *Manpower for Research*.

In the preparation of this report it became clear to the members of the committee that the problem of science in general education extends beyond the elementary and secondary school levels and also beyond the undergraduate level. As a consequence, the committee asked permission from the parent organization to extend its activities to a consideration of general education in science at the college level. This permission was granted and the first effort in this respect was the sponsoring of a Ph.D. thesis at Northwestern University, by R. A. Bullington, on "A Survey of the Present Status of the Science Teaching in General Education in the Colleges and Universities of the Country." About a thousand schools were approached and answers were received from about 65 percent regarding staff, course content, student and faculty reactions, and teaching procedures.

Dr. Bullington's report made it plain that a program of evaluation of the achievements of science courses in general education is of the utmost importance. As a consequence, the committee is now discussing the advisability of evaluation programs.

To bring the recommendation of the various committee reports to the attention of local and state groups, suggestions for an implementation program have been worked out and will be circulated among professional and teaching societies.

The committee also felt that it was necessary to have a member representing the U. S. Office of Education. Discussions with Commissioner McGrath and his staff resulted in the appointment of Bernard B. Watson, of the Division of Higher Education to the Committee, to act as liaison between the U. S. Office of Education and the Cooperative Committee.

At the 1949 meeting of the AAAS, the committee sponsored three symposia. The first, on "Trends in Research," brought selected topics of research to the attention of teachers for use in their classes; the second was a discussion of "The Program of Science in General Education"; and the third, a panel discussion on "The Improvement of Science Teaching at the College Level."

The committee has cooperated with all the teaching societies in setting up a unified program. Twenty thousand copies of the printed program have been issued to teachers all over the nation—a distribution made possible by the generosity of the Welch Scientific Company.

In this way we hope to fulfill some of the functions which the committee anticipated upon its reorganization—namely, to bring to the attention of the public the abiding interest of the AAAS, not only in scientific research, but in the teaching of science.

[4] Personal communication to R. J. Havighurst by B. S. Hopkins.

Bibliography of Papers and Reports Prepared by the AAAS Cooperative Committee on the Teaching of Science and Mathematics

"The Preparation of High School Science Teachers." A Preliminary Report of the Cooperative Committee on Science Teaching. *School Science and Mathematics*, October, 1942, pp. 636–50.

"High School Science and Mathematics in Relation to the Manpower Problem." A Report of the Cooperative Committee on Science Teaching, *School Science and Mathematics*, February, 1943, pp. 127–57.

"Science and Mathematics in Educational Programs for Returning Service Men and Women." Recommendations by the Cooperative Committee on Science Teaching. *School Science and Mathematics*, June, 1944, pp. 517–20.

"The Preparation of High School Science and Mathematics Teachers." Report No. 4, the AAAS Cooperative Committee on Science Teaching, *School Science and Mathematics*, February, 1946, pp. 107–18.

"Problems of the Science Teacher." A Forum presented by the AAAS Cooperative Committee in December, 1946: "Reflections on Science and Liberal Education," Laurence L. Quill; "The Laboratory Problem of the Science Teacher," Morris Meister; "Recruiting and the Economic Status of the Science

Teacher,'' Raleigh-Schorling, ''The Necessity of Science Legislation,'' K. Lark-Horovitz; and ''Resume,'' A. J. Carlson. *The Science Teacher,* February and April, 1947.

''The Effectiveness of Science Teaching,'' A Forum presented by the AAAS Cooperative Committee in December, 1947: ''Why the Report on the Effectiveness of Science Teaching was Needed,'' Philip N. Powers; ''Science in Elementary and Secondary Education,'' Morris Meister; and ''Mathematics—Grades One to Twelve,'' Raleigh Schorling; ''The Effectiveness of Our Schools in the Teaching of the Biological Sciences,''[5] Glenn W. Blaydes and L. V. Domm; ''The Effectiveness of the Teaching of the Physical Sciences,'' Lloyd W. Taylor; and ''Science Teaching Today,'' K. Lark-Horovitz. *The Science Teacher,* February and April, 1948.

''Problems of Science and Mathematics in General Education,'' A Forum presented by the AAAS Cooperative Committee in November, 1948: ''Teaching Science for General Education in the Secondary School,'' G. P. Cahoon; ''Problems of Biology in General Education,'' Prevo L. Whitaker; ''Mathematics in General Education,'' Raleigh Schorling; and ''The Physical Sciences in General Education,'' C. H. Sorum. *School Science and Mathematics,* April, 1949.

''The Cooperative Committee on the Teaching of Science and Mathematics—Its Organization and Program.'' *Science,* July 11, 1947, pp. 28–30.

''Science Course Content and Teaching Apparatus used in the Schools and Colleges of the United States.'' Prepared jointly by a committee on the National Science Teachers Association and the AAAS Cooperative Committee for submission to the Ministers of Education of the Devastated Countries of the United Nations. The Cooperative Committee prepared the college material pp. 51–186 and participated in an advisory capacity in the preparation of the entire report.

''The Present Effectiveness of our Schools in the Training of Scientists.'' The AAAS Cooperative Committee on the Teaching of Science and Mathematics. Appendix II, pp. 47–149. *Manpower for Research,* Vol. IV, *Science and Public Policy,* A Report to the President by The President's Scientific Research Board.

[5] *Ibid.,* with slight modification. *The American Biology Teacher,* 1949, 11, 10.

''Cooperative Committee on Science Teaching.'' *Journal of Chem. Educ.* (news notes) Vol. 19, p. 70, Feb. 1942.

''Cooperative Committee on Science Teaching.'' *Journal of Chem. Educ.* (news notes) Vol. 19, p. 562, Dec. 1942.

''Report of the Committee.'' *School Science and Mathematics.* Oct. 1942.

Lark-Horovitz, K., ''On the Preparation and Certification of Teachers of Secondary School Science.'' *Am. Jr. of Physics.,* Vol. 11, p. 41, Feb. 1943.

Havighurst, R. J. and Lark-Horovitz, K., ''The Schools in a Physicist's War.'' *Am. Jr. of Physics,* Vol. 11, p. 41, Feb. 1943.

Hopkins, B. S., ''Study Problem of the Teaching of Chemistry in the High Schools.'' *Chem. and Eng. News,* Vol. 21, p. 676, May 10, 1943.

Statement of Cooperative Committee to Board of Directors of American Chemical Society on problems of Secondary School Teaching of Chemistry. *Chem. and Eng. News,* Vol. 22, p. 596, Apr. 25, 1944.

Committee on Geological Education of the Geological Society of America. (References refer to work of the committee.) Interim Proceedings of the Geological Society of America: Part 2, Report of March 1946; Part 4, Report of June 1946; Part 5, Report of July 1946; Part 1, Report of March 1947; Part 2, Report of March 1948.

Schorling, R., ''A Program for Improving the Teaching of Science and Mathematics.'' *Am. Mathematical Monthly,* Vol. 55, No. 2, Apr. 1948.

''Science Courses in General Education.'' *Higher Education,* Vol. 6, p. 78, Dec. 1, 1949.

''Science Courses in General Education.'' *Am. Jr. of Phys.,* Vol. 17, p. 526, Nov. 1949.

''Science Teaching Symposium.'' *Chem. and Eng. News,* 1949, Vol. 27, p. 3508, Nov. 21.

Riddle, Oscar, ''The Preparation of High School Science Teachers.'' *The American Biology Teacher,* 5, 63–65, 1942.

''Deficient Instruction in Biology in High Schools,'' unsigned editorial by Oscar Riddle. *Journal American Medical Association,* 125, 356–7, 1944.

Riddle, Oscar, ''Education for *All* American Youth'' (from the point of view of a biologist), *School and Society,* 61, 113–16, 1945.

Lee, Oliver J., ''The Teaching of Science and Mathematics.'' *Popular Astronomy,* 54, 382–4, 1946.