ing an unemployment crisis practically immediately upon the conclusion of peace.

3. J. M. Keynes, *The General Theory of Employment, Interest and Money* (Harcourt Brace, New York, 1936).
4. There is a special possible exception to this theory of collapse. It could be that about the time further *net* accumulation ceased to be necessary, the replacement demand to maintain the (hitherto) growing stock of capital would increase. Thus the gross demand for newly produced equipment and capital goods would not drop, though demand for a *net* increment had fallen to zero.
5. See J. S. Mill, *Principles of Political Economy,* ed. 6, book IV, chap. IV, sect. 4 "Such a country . . . is habitually within as it were a hand's breadth of the minimum and the country therefore on the verge of the stationary state." Ricardo's views, which I here paraphrase and summarize, will be found scattered through his various books, pamphlets, letters and notes, all set forth in *The Works and Correspondence of David Ricardo* (10 vol.) edited by Piero Sraffa with the assistance of M. H. Dobb (Cambridge Univ. Press, London, 1951). A typical quotation from Ricardo's works (vol. 2, p. 438) is as follows: "no mistake can be greater than to suppose any evils whatever can result from an accumulation of capital. The sole consequence might be an indisposition to accumulate further from the fall of profits."
6. The special risk, which Keynes particularly elaborated, is that of a capital loss if prosperity returns and the rate of interest *rises.* A perpetual income of a dollar a year at 2 percent has a capital value of $50. At 4 percent its capital value is only $25. Because of this special danger of capital loss, men may hold money rather than invest it at low interest rates. Keynes called this the "speculative motive" of "liquidity preference." The subject has become much tangled in elaborate verbiage. Increasingly, however, it is being realized that Keynes' theory can be treated as supplementary to, rather than contradictory of, "orthodox" theory. See my "The future of Keynesian economics" (*1*) for a technical discussion.
7. An elaborate explanation of this problem, in simple language, will be found in D. M. Wright, *A Key to Modern Economics* (Macmillan, New York, 1954), chap. IX, sect. 2. The reader is referred to this book for general elaboration of the points set forth in this article.
8. I have given an elaborate theoretical analysis of the interrelations (and lack of interrelation) between markets in "What *is* the economic system?" *Quart. J. Econ.* (May 1958). The egregious failure of most Keynesian forecasts after World War II was very largely due to an unexpected upward jump of the consumption level. Similarly, in 1953 and again in 1958 the Keynesian models of mechanical interrelationships between investment and consumption did not work out. Of course this does not prove that his model cannot sometimes be useful. It only proves that it is not universal or reliable.
9. For an analysis of some of these problems of speed which the socialist planner encounters, see D. M. Wright, *The Economics of Disturbance* (Macmillan, New York, 1947), chapters III and VI. This book was written during the war and its analysis was worked out entirely from *ad hoc* logic, given a few premises which I believed to be true. It has, therefore, been extremely interesting to watch the subsequent accumulation of an immense mass of data illustrating the practical occurrence of the dilemmas therein predicted.
10. Examples of failure of the postulated Keynesian relationships are mentioned in (*8*).
11. Keynes' views on wages have been particularly often misunderstood and misstated. How many people, for example, remember that Keynes wrote the following: "When we enter on a period of weakening effective demand a sudden large reduction of money wages to a point so low that no one believes in its indefinite continuance would be the event most favorable to a strengthening of effective demand" (*3,* p. 265). Or, "a general reduction [of money wages] may also produce an optimistic tone in the minds of entrepreneurs, which may break through a vicious circle of unduly pessimistic estimates . . . and set things moving again on a more normal basis of expectation" (*3,* p. 264). Finally, in his *Essays in Persuasion* [(Harcourt Brace, New York, 1932), p. 341] he refers to the labor unions as "once the oppressed, now the tyrants, whose selfish and sectional pretensions need to be bravely opposed." The truth is that, scientifically, Keynes was a highly schizoid character.
12. Concerning the "perspective" of profit, see D. M. Wright, "What *is* the economic system?" (*8*).

Science Teaching Improvement Program

Changes in interest in science education point to gains, if regional effort can be increased.

John R. Mayor

In the 3 years since a grant from the Carnegie Corporation enabled the American Association for the Advancement of Science to begin its Science Teaching Improvement Program (STIP), a very substantial change has developed in the United States in the interest in and attitudes toward the teaching of science and the education of science teachers. Most of the change has been in attitudes and interest, for a 3-year span is not long enough for alteration in the materials actually taught or in the ways in which teachers are prepared for their responsibilities. But the changes in interest and attitude are forerunners of changes in practice, and already it is evident that major changes in practice are coming. The great expansion in number of summer and academic-year institutes for teachers and the several well organized efforts to prepare up-to-date course material of high quality in physics and mathematics are outstanding examples. Further evidence is provided by the increasing number of colleges and universities that are offering special science and mathematics courses for teachers and prospective teachers, the number of states and universities in which special committees of scientists and educators have been established to work together on problems of teacher preparation, the increased number of studies being conducted of the science curriculum and of science teaching materials, and the greatly increased willingness of scientists to devote time and thought to the problems of education below the collegiate level.

There is no way of knowing—and we have made no attempt to find out—how much of the credit for these changes can properly be given to the AAAS and its Science Teaching Improvement Program. The STIP staff and publications, and the annual meeting and committee resources of the AAAS have been wholly or in part directed toward these ends. Part of the change can no doubt be credited to the Association's activities.

Instead of considering the unanswerable questions of proportion of credit, it will be more useful to describe the work done.

Use of Science Counselors

Many persons teaching high-school science and mathematics courses are not adequately educated in the fields of knowledge they teach. As one means of improving the quality of teaching in science and mathematics, arrangements were made with the state universities of Oregon, Nebraska, and Texas, and Pennsylvania State University, to employ two

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experienced and highly qualified teachers to serve as counselors to less experienced colleagues in the regions surrounding those universities. In each state a science counselor and a mathematics counselor were employed. In each state the program was developed with full cooperation from the state department of education, the university science, mathematics, and education departments, and the high schools concerned. The counselors were employed as members of the university staff and served, essentially, in an "extension" capacity. Each visited teachers within a prescribed geographic region (usually about 100 teachers per counselor) to help those teachers with problems of subject matter, teaching, use of equipment, examinations, science fairs or other such activities, and use of local educational resources outside the formal school system. Emphasis was on subject matter, rather than pedagogy. The cost was largely borne by grants made by the Association, but in no case did the grant cover all of the costs; the university had to be sufficiently interested in the program to share part of the expense.

An evaluation of this program through questionnaires and interviews with teachers, university faculty members, superintendents and principals, and others involved has been carried out by John W. Gustad of the University of Maryland and will be reported in full at an early date. Such informal evidence as comes from letters and reports indicates that the program was effective, successful, and —after an initial period of uncertainty and in a few cases some suspicion—well liked by all of the groups involved.

More tangibly, the University of Texas is continuing the program, with financial support from the school districts visited by the counselors. In fact, the program has been so well received that additional schools have wanted to be included. In the other three states the program has been dropped for the year 1958–59 because financial arrangements for its continuation had not been worked out. But in all three places, efforts are being made to resume the use of science and mathematics counselors in the fall of 1959 with financial support from the university budget.

Broader recognition of the usefulness of science counselors was evident in the inclusion of provisions for such counselors in the education bills introduced into Congress in 1958 by the Administration and by Senator Hill and Representative Elliott. The provisions of the Hill-Elliott bill were quite directly based on reports of the Association's counselor program. In the National Defense Education Act of 1958, federal grants to the states for the improvement of science, mathematics, and foreign language teaching are made contingent upon the expansion or improvement of supervisory services similar to those performed by the counselors in the Association's program. It is possible that in another year science counselors may be active in all 49 states.

Education of Science Teachers

The widespread concern with the problem of improving the education of science and mathematics teachers has been shared by the Association, and several efforts have been made to improve teacher education.

Joint Commission on the Education of Teachers of Science and Mathematics. In the fall of 1955 the AAAS, the National Science Foundation, the U.S. Office of Education, and the American Association of Colleges for Teacher Education held a small conference on the problem of securing greater cooperation between scientists and educationists in the education of science teachers. As a means of continuing the purpose of this conference, early in 1956 the AAAS and the American Association of Colleges for Teacher Education formed a Joint Commission on the Education of Teachers of Science and Mathematics. The Joint Commission consists of four representatives of each of the parent organizations plus one representative each of the National Science Foundation, the U.S. Office of Education, the National Science Teachers Association, the National Council of Teachers of Mathematics, the American Council of Learned Societies, and the Association of American Colleges.

In the course of a series of meetings, the Joint Commission developed a program of experimental studies on teacher education, but it was never possible to come to full agreement on which such studies were of greatest importance and how they might best be handled. Out of this inability came another result of potentially greater usefulness: an examination of the basic question of what the science curriculum in elementary and secondary grades should be. A statement on elementary and secondary school science education has been prepared and has provided the basis for a number of recommendations concerning both preservice and in-service education of science teachers. This statement has been agreed upon by the members of the Joint Commission, has survived the criticism and gained the endorsement of several conferences of scientists, educationists, and school teachers and administrators, and is now being prepared for publication.

Conferences for Staff Members of Teachers Colleges. A considerable fraction of the nation's school teachers are trained in state teachers colleges. Two conferences were held for staff members of such institutions, one in Chicago in 1957 for representatives of midwestern institutions, and one in Washington, D.C., in 1958 for representatives of mideastern states. These were two-day conferences, involving both scientists and educationists, in which emphasis was upon subject matter education.

In-service Training of Teachers in the Washington, D.C., Area. The AAAS cooperated closely with the National Academy of Sciences–National Research Council in developing a local program of teacher education. It involved cooperation among the several school districts in and surrounding Washington, D.C., the several universities in the area, local parent groups, and local industrial and business representatives. The purpose was to try to develop a locally sponsored and financed program, without outside financial aid (except for the very substantial amount of time that went into planning and organization on the part of AAAS and NAS–NRC staff members). Arrangements were made for the universities to offer special courses during the summer months, and for the local school systems (or other local sources of funds) to provide stipends for the teachers who enroll in these courses. The program is continuing.

Experimental Course for Mathematics Teachers. With the cooperation of the National Academy of Sciences–National Research Council, the department of mathematics of the University of Maryland, and the Walter Reed Army Medical Center, an experimental course in the concepts of the calculus for high-school teachers was given over closed-circuit color television during the 1957–58 school year. The NAS–NRC is hoping to make kinescopes available for use in several other centers during the academic year 1958–59, and the AAAS will be involved in the planning for this use of the kinescopes.

Correspondence Courses for Teachers. STIP has worked with a committee of the National University Extension Asso-

ciation in preparing a summary of extension courses that are now available for in-service teachers. The list will be published and the committee intends to encourage the development of additional courses during this coming year.

Certification of Teachers

The bases on which persons are certified as qualified to teach, or to teach specified subjects, is a topic of wide current concern and discussion. One of the major points involved is the amount and nature of subject matter preparation to be required. STIP has worked closely with the National Commission on Teacher Education and Professional Standards and has selected scientists to work with state and regional teacher education and professional standards organizations during 1956–57 and 1957–58. These meetings culminated in a national conference held in Bowling Green, Ohio, on 24 to 28 June. In attendance were some 250 scientists and representatives of other academic disciplines who had been invited by the AAAS, the National Academy of Sciences–National Research Council, and the American Council of Learned Societies. A special grant of the Carnegie Corporation to the National Commission paid some of the unusual costs of this conference. The recency of the meeting means that the only available evidence concerning its effect is of the "testimonial" variety, but that evidence indicates a highly successful meeting that will increase substantially the extent to which subject-matter specialists and educationists work jointly on matters of teacher preparation and certification, and that will increase substantially the number of subject-matter specialists who are actively involved in decisions concerning teacher certification.

Certification requirements vary substantially from state to state. Representatives of the Science Teaching Improvement Program have conferred with officers of the National Association of State Directors of Teacher Education and Certification in the planning of a national study of teacher certification practices, a study that will lead, it is hoped, to agreement on basic principles and reciprocity patterns among the states. The National Association of State Directors of Teacher Education and Certification has asked for a greater amount of continuing assistance as the study is carried out.

Cooperation between Scientists and Educationists

One of the major objectives of the Science Teaching Improvement Program has been to close the gap between scientists and educationists and to get the two groups to work cooperatively on the development of curricular materials, the education of teachers, and the decisions that are constantly being made concerning the teaching of science and mathematics. A number of the specific activities described above have had the closing of this gap as one of their objectives, and, as has been pointed out, have had some success in this direction.

In addition, representatives of the Science Teaching Improvement Program have taken part in a large number of local, regional, and national meetings that have had the improvement of relations between scientists and educationists as a goal and as an effect. Visits have been made to nearly 150 colleges and universities in the past 3 years to hold conferences and discussions and to give talks on teacher education problems. Representatives of STIP have attended meetings of more than half of the 41 academies of science affiliated with the AAAS, where they have presented papers, met with education committees of the academies, and helped to institute programs that have been followed up by various kinds of activities on the part of the academies. Papers have been prepared for publication and speeches have been given at meetings of a large number of educational associations and organizations.

With the existing decentralization of school control in the United States, the talk that goes on at national level about improving science and mathematics instruction has no effect until it gets translated into local action decisions. Much of the above-described effort has, naturally, consisted in encouraging and helping local groups to decide how they can work most effectively. One encouraging development is the inclusion in the 1959 budget of the National Science Foundation of money for grants to academies of science for science teaching improvement activities. The AAAS helped to stimulate the availability of this money and has consulted with many of the academies of science on the development of programs which might appropriately be supported by grants from it.

As a further effort in the direction of better cooperation between scientists and educationists, the Science Teaching Improvement Program appointed 20 regional consultants, university scientists interested in the improvement of education, who served through 1957 and the first half of 1958. Each worked within his region in much the same way that the small Washington STIP staff did on a national basis. Funds for their travel and expenses came from a grant to the Association from the General Electric Educational and Charitable Fund.

Particular mention should be made of advisory and consultative services in Washington, D.C. The Association has worked very closely with the National Academy of Sciences–National Research Council on a number of matters. The STIP staff has been available for frequent consultation with the National Science Foundation, the U.S. Office of Education, the President's Committee on Scientists and Engineers, and a large number of educational organizations.

Regional Action

The importance of action at the local community level has already been mentioned. As a special effort in this direction, the Science Teaching Improvement Program and the Educational Advisory Board of the National Academy of Sciences–National Research Council, with the financial support of the Hughes Aircraft Company, in 1957 planned and conducted at Lake Arrowhead, California, a conference of school administrators, scientists, and industrial representatives on the problems of industrial support for education. The conference was a highly successful one that led to the immediate creation of a local organization, financed by industry and directed by a science teacher released from a southern California school for that purpose, to coordinate the work of industry in providing equipment, summer position opportunities, and other aids to education. The conference served as a model for the President's Committee on Scientists and Engineers and became the basis for the extensive "local action" program of the President's Committee.

Special Activities

Of a number of special activities carried out during the past 3 years, four merit special mention. One was the holding of two conferences on mathematics instruction. The several organizations in-

terested in the improvement of mathematics instruction were all working quite independently. With the aid of a special grant from the Carnegie Corporation, two conferences of representatives of these organizations were held to discuss the problems in which all were interested.

Inclusion in the major education bills before Congress of provisions for assistance to the states on programs of student testing and guidance led to two simultaneous conferences in May 1958 of experts in testing and experts in student counseling. The purpose was to prepare recommendations that might be transmitted to state school officials for the improvement of their testing and guidance programs or the institution of such programs. The reports of the two groups are now available. The conferences were financed by a grant from the Carnegie Corporation and were planned with the cooperation of the American Personnel and Guidance Association and the American Psychological Association.

The large amount of interest in activities intended to interest children and high-school age youth in science led to the holding of a national conference of representatives of academies of science and junior academies of science. The conference provided an opportunity for exchange of information and ideas, and has resulted in the stimulation of increased activity on the part of state academies of science in providing programs of interest to elementary and high-school pupils. The national conference was supported by funds from the Oak Ridge Institute of Nuclear Studies and the National Science Foundation.

STIP has worked with a committee of teachers and parents in the Washington area during 1957–58 on planning for a course in science for grades 5 and 6, which is being offered by open-circuit television during this school year. The course has become a part of the science offerings for these grades in 16 school systems.

Information Newsletter

To help meet the need for exchange of information among the many organizations and agencies interested in the improvement of science and mathematics education, the Association's Science Teaching Improvement Program has prepared and circulated a semiannual newsletter reporting the science education activities of scientific societies and of a few government and industrial agencies.

Some Disappointments

Various things that those responsible for the Science Teaching Improvement Program and the Association's Cooperative Committee on the Teaching of Science and Mathematics had hoped to accomplish have not been done.

There was initially some hope that it would be possible to develop material that would be useful in interesting students in careers in science. After hundreds of samples of the literature already available for this purpose had been examined, it was decided not to enter this field.

We had hoped to make some direct contribution to the improvement of teachers' salaries and the betterment of their working conditions. Particularly disappointing has been inability to work effectively on our own or with other groups toward this goal.

When the Science Teaching Improvement Program was originally planned, it was hoped that one of its aspects could be a substantial national program of awards to outstanding high-school teachers of science and mathematics. The Association's officers were quite aware of the difficulties involved, but still believed that such an award program would constitute a useful part of the effort to enhance the prestige of competent teachers. Apparent success in securing financial support for such a program turned out to be illusory, and nothing more has been done on this aspect of the original Science Teaching Improvement Program.

News of Science

Evolution of the Organization of the Federal Government for Scientific Activities: the Beginning to 1947

In 1956 the Office of Special Studies of the National Science Foundation published a report which was titled *Organization of the Federal Government for Scientific Activities*. Part 1 of this report offers a brief examination of the history of the relationship between government and scientific activity in this country. Excerpts from this study are presented here. A second article will cover the period from 1947 to the present.

Early Organization

The Federal Government's organization for science began to take shape soon after the founding of the republic. It evolved slowly for the first hundred years, the pace quickening during the first part of the 20th century. Beginning in World War II, and continuing into the postwar period, there was a spectacular growth in the number and size of scientific agencies and in the scope and significance of their work.

This process of development has been paralleled by the growth of scientific activities in the nation at large. A phenomenal increase in the magnitude of the industrial scientific effort has occurred as industries which depend on technological progress have added to their scientific work, and as others which never before supported research have begun to do so. Basic research, too, has received increasing attention in industry.

The scientific activities of the Federal Government in the years before the Civil War consisted principally of the observation and collection of data about natural phenomena. The Naval Observatory, the Coast Survey, and the Army's Topographical Engineers were busily engaged in accumulating information to aid the nation's commerce and defense, and its westward expansion. The Smithsonian Institution, established in 1846, supported several important scientific activities which were later taken over