# The Common Ground of Science and Politics

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IT IS MY PURPOSE to speak along lines forecast by the healthy tradition that has lately been developed by my predecessors in this particular spot in the Annual Meeting of the AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Instead of discussing some specific problem or some notable progress within the field of geology, my special department of the physical and biological sciences, I shall consider certain of the broad problems arising from the impact of science on modern life. Such a procedure has become standard practice for retiring presidents ever since the last meeting of the Association in St. Louis, in 1946, when A. J. Carlson raised the question "Be There 'a Standard to which the Wise and the Honest Can Repair'?" Perhaps it will be appropriate to think of my address as a sequel to his.

At first thought, there are those who might cynically inquire, "Is there any common ground at all between two such antagonistic fields of activity as science and politics?" Conflicts between scientists and politicians have been so widely publicized in recent months that there might seem to be adequate basis for such a question. Scientists have criticized politicians for their ignorance of the strategy and procedures that have proved so efficient in the progress of science. Politicians have berated scientists for their impractical idealism and have even denounced them as subversive when they object to security regulations and procedures that seem to them inimical to the continuing development of scientific knowledge.

It is obvious, however, that America needs both wise and honest politicians and intelligent and conscientious scientists. Either vocation should deserve as much respect and receive as much honor as the other. In spite of the fact that there was no reference whatever to science in the platforms of either the Republican or the Democratic party, drafted in preparation for the 1952 political campaign, the politicians who phrased those platforms were well aware that the successful candidates would necessarily depend heavily upon the work of scientists for progress toward many of the objectives they promised to reach.

Scientific research and development have become a major enterprise in the United States during the years of our lives. Politicians recognize quite generally the value of that enterprise and the fact that national security has become increasingly dependent upon its success. The strength of our military defense is measured by the achievements of science more than by any other factor. This is not just a matter of atomic bombs, whether of the fission or the fusion type. Of the three billion dollars spent on science in America during the years 1941–45, exclusive of the money devoted to the development of the atomic bomb, 86 per cent was paid by the U. S. government. Five sixths of the federal expenditure was made through the Department of Defense.

Governmental agencies also depend upon science for the improvement of the public welfare, as well as for the strengthening of military defense. The federal budget for scientific research that contributes to public health, better living conditions, more efficient and widespread use of natural resources, improved educational techniques, and all such factors that make for "better living" is now well over half a billion dollars per year. It is quite unnecessary to labor the point. Politicians need scientists in their business, and will need them more rather than less, as the years come and go.

But this is a two-way street. Scientists are increasingly dependent upon politicians. Approximately 35,000 specialists in the physical, biological, agricultural, and engineering sciences are now employed in government laboratories and research facilities, working under the supervision of politicians. Much of their work is in the development and application of science rather than in fundamental research, but this is "science" nonetheless. Furthermore, thousands of scientists employed in colleges, universities, and industries are actually supported by federal funds, made available for that purpose by vote of the Congress. More than a hundred million dollars is channeled each year through educational institutions, and thrice that amount through industrial laboratories, for research and development under governmental supervision.

It was the scientists of the country who appealed to a reluctant Congress for legislation establishing the National Science Foundation. They had pointed out the many important functions that such an agency, supported by federal funds and administered by civilians, could best perform. The needs were obvious, the procedures clearly defined, and yet the response has not been nearly as generous as the nation's welfare demands. Beyond doubt the scientists will be requesting increased support from the politicians in the coming years.

Surely, all will agree that, if the interdependence of science and politics is not as clearly comprehended as it ought to be, something should be done to make their common ground more obvious. The time is certainly at hand for a moratorium on mutual recrimination, suspicion, and jealousy between scientists and

[1] Based on the address of the Retiring President, delivered at the Annual Meeting of the AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, December 28, St. Louis, Mo.

politicians, and for a rebirth of a spirit of fair play, constructive cooperation, and mutual understanding. To that end, it is well to consider first the objectives that they hold in common.

Science has a dual objective, and therefore scientists have two functions. On the one hand, science is the quest for knowledge of a certain kind—the kind that leads to the formulation of general laws connecting a number of particular facts. Therefore, the scientist may seek knowledge solely for its own sake and for the satisfaction of his inner urge toward broader, deeper understanding of the nature of the world and of man. Such has been the motivation of many of the greatest scientists of all times. No consideration need be given to the consequences of the results of his search, insofar as they may be useful for any purpose whatever in the practical affairs of everyday life. The only requirement is that each newly acquired bit of information and each new conceptual scheme be fruitful for additional steps that he may take in his quest for knowledge and for truth.

On the other hand, science is power of a certain kind—the kind that makes it possible for men to manipulate nature. The scientist may thus seek scientific knowledge in order that it may be applied to increase the efficiency and the comfort of mankind. This may involve just as fundamental research as any other, or it may be merely the development of techniques and gadgets whereby new concepts are translated into practical operations. It is significant that when scientists today are philosophizing, they are more likely to distinguish between "fundamental research" and "technological development" than between "pure science" and "applied science." The fact is, of course, that every item of scientific knowledge ever gained, in response to whatever motive, has been found sooner or later to have practical significance, either directly or indirectly, in human affairs. Rash indeed would be the scientist who dogmatically asserted that knowledge about nuclear fusion could never contribute to human welfare, impossible though it may now seem to be to imagine that the hydrogen bomb could ever be anything but a horrendous weapon for cataclysmic destruction. Even that, of course, has its far-reaching significance to modern man.

Politics likewise has a dual objective. On the one hand, politics is the administration of the state and the management of public affairs, directed toward the maintenance of order within the nation and its protection against foreign foes. Therefore, politicians enact laws to govern the activities of citizens, limiting their behavior to orderly procedures, and to provide police power to restrain lawbreakers and protect the state. Army, Navy, and Air Force, in the political structure of the United States are, appropriately, administered in the Department of Defense. Concentrating on this objective of politics, the politician seeks power *over* people. Orders are issued; obedience is demanded; disobedience is punished. On occasion, the military power of the state is used for aggressive warfare, the better to protect the state from its external enemies, or for the purpose of bringing more people and more resources under its control.

On the other hand, politics is the administration of the state and the management of public affairs, directed toward the betterment of human welfare and the enrichment of the lives of individuals of whatever status. This far transcends the other objective, with its concentration on order and stability. In recent years, every state, the world around, has become increasingly a social service state. Politicians have found it politic to seek and gain power *with* people, rather than merely to seize and hold power *over* people.

There is also another bifurcation within the political sphere. Whether or not the greater emphasis is placed on one or the other of the two objectives of politics, the goals may be sought in either of two ways. One way involves government of all the people, for some of the people, by a very few of the people. That leads to regimentation within dictatorships and establishes an autocracy. The other way leads to government of all the people, for all the people, by all the people. That involves the universal acceptance of the responsibilities of self-government and establishes a democracy. To those who are prone to quibble about the fact that the United States is officially a republic rather than a democracy, I would suggest that our republic has the structure of a representative democracy, one of several possible alternatives for the democratic pattern of government.

Autocratic politicians, attempting to concentrate power in their own hands, are very likely to look upon science as a most important servant of the state. This, of course, is the attitude in the Soviet Union at the present time. The physical and biological sciences are employed to yield technological improvements, raise living standards, and strengthen police power. The social sciences are especially useful in maintaining control in the hands of the rulers. The techniques whereby minds are manipulated through propaganda have been described and in some instances developed by social psychologists. These techniques have been quickly learned and effectively used by politicians to maintain the supremacy of the state and to achieve their own ambitions for personal power.

To an even greater extent, the politicians in a democracy are necessarily concerned with the progressive development of the sciences and their application to all aspects of life. Such politicians are at least in theory the servants of the people. The citizens who have chosen them as their representatives demand that in all considerations of administrative policy high priority be given to their own economic, social, and cultural welfare. They are likely to insist that the benefits accruing from scientific and technologic achievements be shared as widely and as equably as possible. Both politics and science are expected to operate in the service of mankind. On that common ground the politicians and the scientists should work together in wholehearted cooperation.

Unfortunately, however, such cooperation is not now being displayed in the United States to anything like the extent that is obviously desirable. Competent scientists are reluctant to accept employment with the federal government, and many of those now in the civil service would be glad to leave it for other jobs. A survey of the attitudes of scientists toward various types of employment, made by the President's Scientific Research Board and published in 1947, indicated that of all the scientists questioned "only 11% preferred a Government career. Thirty-one percent preferred industry and 48% the university environment. The remaining 10% preferred consulting work or some other activity." That low estimate of government service as a career is evidently not significantly a matter of financial rewards. The salary scales in industrial laboratories are far higher than those in government bureaus, but the latter are at least as remunerative as those in educational institutions.

That survey was made prior to October 1947. Since then, the search for disloyalty among government employees and the procedures followed by security boards have had their deleterious effects upon government employment. It is almost certain that a similar survey made today would reveal an even lower appraisal of the opportunity afforded by the government for a successful career in science, in comparison to that available in other ways.

Friction between scientists and politicians extends, even more unfortunately, far beyond the area in which the politicians hold the purse strings and therefore can enact the detailed regulations which the scientists must obey. The *Internal Security Act* of 1950, popularly known as the McCarran Act, and the *McCarran-Walter Immigration Act* of 1952 have dropped a "red tape curtain" around the United States, which in many evil ways resembles the Iron Curtain around the Soviet Union. Each of those measures was passed by the Congress over the veto of President Truman. In his veto messages, the president spelled out the harmful consequences of the legislation to the nation, and displayed a far clearer comprehension of the bad effect it would have upon science in America than was displayed by those who voted to enact it. The dire impact of that legislation upon science in America is so well known that I do not need to tell the story here.

This whole question of the conflict between intellectual freedom, essential to the uninterrupted progress of science, and national security, essential to the preservation of our country in this period of real danger, ought to have much more careful study than it has yet received. It is so confused by prejudice, suspicion, and fear that it is almost impossible to remove it from the fires of emotion and weigh it on the balance of reason. But unless this is done the welfare of our country will be seriously jeopardized.

Most of the freedoms that we hold so dear are relative freedoms, to be exercised only within more or less clearly defined limits. Some of them have to be abandoned or more sharply restricted in time of war, either hot or cold. The most basic freedom of all is intellectual freedom, the right of a man to think his own thoughts and announce them without fear to those who will listen to him. This is the freedom that is safeguarded by our Constitution's Bill of Rights, although there it is spelled out in terms of freedom of speech, of the press, of peaceful assembly, and of the free exercise of religion. It is, in fact, the very touchstone of democracy, the creator and preserver of the orderly flexibility that makes democracy so much more efficient and desirable than any autocracy. The real test of democracy is not applied by asking questions about the statements embodied in a nation's constitution or the presence or absence of ballot boxes and universal suffrage. If anyone wants to know whether the community, state, or nation in which he resides is truly democratic, let him ask this question: What actually happens to the member of an unpopular minority when he dares to speak his mind in opposition to the spokesmen of the popular majority?

When that test is applied to the organizations and communities of scientists in the United States, they are found to fall within the democratic bands of the broad spectrum that ranges from stark autocracy at one end to perfect democracy at the other. In fact, many of the significant new ideas that have led to progress in each sector along the expanding frontier of science have been first proposed by an individual, or a small minority, in opposition to views widely held by large majorities. The novel concepts have been appraised in the market place of public opinion. Each scientist has been encouraged to form and express his own independent judgment. No hierarchy of academicians has decreed what is orthodox, or branded as subversive anyone who deviated from the approved "line." Even though one scientist may strongly disagree with another's opinions, he knows he must defend the other's right to express them, else he will be false to his calling as a seeker for more accurate understanding of the ways of nature. If the suspicion should enter his mind that perhaps in times of ideological conflict a little thought control might be desirable, he has only to remind himself of the sorry plight of the biological sciences in the Soviet Union.

Intellectual freedom for scientists inevitably conflicts with the necessity for national security. To what extent and in what ways should it be limited? The answer to that question has thus far been given by the politicians, with woefully inadequate consideration of the scientist's point of view. Political screening is necessary in certain sensitive areas where scientists deal with military secrets. Unfortunately, those areas have been either too loosely or too broadly defined. They should be restricted to the absolute minimum. The ideas of competent scientists concerning what that minimum should be ought to have far more respectful consideration than they have thus far received.

The nature of the political tests also needs reexamination. The fundamental difficulty here arises from a basic disparity between the mental processes

of scientists and politicians. In debates across a frontier, the primary aim of the true scientist is to understand rather than to refute. In such debates, most politicians aim to demonstrate their own worth and insist upon the correctness of their own views, rather than attempt to understand an opponent's ideas. Altogether too few politicians in America display the intellectual qualities of political scientists.

Consequently, the scientist who tries to understand the motives and the behavior of people on the other side of the current ideological conflict is engaging in an intellectual enterprise quite foreign to the politician's mental and emotional habits. He is therefore open to suspicion and will almost certainly be caught by the political screen of "reasonable doubt." There is of course some truth in the well-known saying that a man is known by the company he keeps. But that method of appraisal is valid only when it is taken to mean: a man is known by all the company he keeps. To base conclusions solely upon a man's associations with a few organizations or individuals, especially selected by angry politicians, is both unscientific and unjust. Either all his associations, or none, should be considered by those responsible for political screening to ensure national security.

It would be bad enough if the harmful policies and practices were applied only to the scientists working on projects that have security implications. Actually they are extended far beyond that relatively small group. Political orthodoxy, rather than mere technical competence, has been accepted as a basic qualification in many academic institutions and industrial laboratories, even when the work is completely unclassified and does not involve access to anything that could be considered a military secret. Administrators dare not risk charges that might be made by Congressional committees, or by radio and newspaper commentators, that they are employing "red" scientists. Many institutions have their own security officers, who are concerned not only with the personnel employed in classified projects, but also with those engaged in scientific research not covered by security regulations. Particularly where academic tenure is not a stumbling block, it has been comparatively easy to dismiss, or to bar from employment, capable scientists accused of past association with organizations now considered questionable or subversive. The number of such tragedies is far greater than any statistician can ever discover. Both the unfortunate victims and the institutions by which they have been employed have characteristically shunned publicity, for reasons that may differ from case to case but add up to a definitely hush-hush policy.

Intellectual freedom involves the free interchange of information and ideas among scientists not only within our country but also between and among those of all nationalities. Among the most stimulating factors in scientific progress are the international gatherings of specialists in the various scientific disciplines and the visits of foreign scientists to the centers of research and development in the United States. Few persons, other than the scientists themselves, are aware of the tremendous indebtedness of American technology to scientific research prosecuted in other countries. Freedom to travel may not be one of the justly celebrated "Four Freedoms," but for the man of science it ranks at least as high as any other.

Especially since the passage of the *McCarran Act* in 1950, the Department of State has been exercising increasingly rigid control over the movements of American and foreign scientists, both in and out of our country. The power to withhold passports and visas is one which, when improperly used, can deal a telling blow to scientific progress. International gatherings of scientists have been curtailed, both in America and abroad, by the establishment of political and ideological tests of fitness to enter or leave the United States. Individuals of unquestionably high scientific competence have been denied passports for travel abroad, in some instances to pursue research projects of vital importance to our country. Foreign scientists of equally fine standing in their professions have been barred from entrance, even when invited for specific services to be rendered at some of our most important universities or laboratories. In each instance the refusal is explained on the grounds that the issuance of the requested passport or visa is not in "the best interests of the United States."

The repercussion of such events throughout the great body of American scientists cannot but be deleterious in the extreme. Not knowing what alleged crimes have brought this penalty upon one of their number, the scientists, upon whom the future security and prosperity of our country depend, find their efficiency decreased in subtle but significant ways. Each will decide that the only way to avoid a similar fate is to withdraw completely from all participation in public affairs. No longer will they dare to give critical consideration to the social implications of their work. In one large compartment of their lives, in which they should accept their responsibilities as citizens in a democracy, they will fit their minds into the Procrustean bed of rigid conformity to official governmental policies and majority opinion. How soon this acceptance of authoritarian dictates will carry over into the other compartment of their lives, in which scientific habits of thought have proved so invigorating for scientific progress, is a neat question for the psychologists. At the moment, it is generally held that schizophrenia is quite bad for man.

Certainly the scientists of America cannot be expected to do their best work as long as they remain in the stultifying atmosphere that has been imposed upon them by political trends. The appeal to get them out into the fresh air, where the winds of freedom and confidence will once more stimulate them to high intellectual adventure, is based not so much upon selfish desire for the personal welfare of individual scientists, as upon the recognition of what is absolutely essential to the continuing health of science as an

important contributor to the future of America.

Scientists and politicians have so much to do when they get together on the common ground of service to mankind, that friendly cooperation, in mutual trust, should certainly be the aim of all. Scientists have solved most of the technical problems of reducing infant mortality and prolonging life through sanitation and medicine. Politicians have provided public hospitals and public health agencies. They are jointly responsible for the unprecedented increase in world population that has characterized the first half of the twentieth century. Scientists must now accept the responsibility of solving the technical problems involved in providing adequate subsistence for growing populations. And politicians must arrange for appropriate sharing both of technical skills and of the means of subsistence in all parts of the world.

These are not impossible tasks. I have no space to develop details—I simply assert that in my opinion the resources of the earth, when made available by the science of today and tomorrow, will prove adequate to meet all the needs of mankind for untold years to come. The present rate of population increase is both unprecedented and temporary. It is far lower in those parts of the world that are now enjoying an economy of plenty than in those parts still laboring within an economy of scarcity. The politicians of India have followed the advice of scientists and have adopted a decreased birth rate as an item of national policy. There is good reason to expect that the world's net reproductive rate will be appreciably lower by the end of the century than it is at present.

The goal for this joint task force of scientists and politicians should be a standard of living everywhere at a level adequate to promote social and political stability in a free and democratic society. That is quite different from attempting to provide an American diet and an American standard of living for all people everywhere. The physical and biological scientists are already well on the way toward solving the technical problems along the route to that goal. Their part of the task is in accord with their well-established habits of mind and their attitudes toward human welfare. For politicians, however, this will be a different story. The management of public affairs is inherently more difficult than the management of soils, seed crops, or livestock. Politicians will need all the help that the social scientists and the educators can give them. Moreover, politicians have for the most part been thinking within the framework of an economy of scarcity, even in lands where the industrial and agricultural revolutions, made possible by science and technology, have brought prosperity to fortunate people. It will be quite a feat of mental and emotional gymnastics for them to reverse the field and formulate policies appropriate to an economy of plenty.

Education will obviously play a major role in this project, and educators also are cultivating this same "common ground." Indeed, there is plenty of room within its broad horizon for artists, men of religion, and many others. In a very real sense, an educator is a sort of hybrid individual, combining many of the characteristics, methods, and aims of the scientist and the politician. Be that as it may, the educators, too, will have to blaze some new trails.

In many insufficiently developed regions, fundamental education, urgently needed by adults as well as children, should have much more emphasis upon science than is currently given. Adherence to long-established policies of teaching classics, literature, and philosophy leads to the slighting or even the omission of science in certain countries. Emphasis upon trades and technical skills, in other programs, fails to inculcate knowledge of the methodology of science.

Even in countries like our own, where the teaching of science is stressed almost or quite to the point of slighting the humanities and the fine arts, there is a challenge to educators far more basic than that of perfecting the techniques of education. The great body of scientific knowledge appears to be a collection of separate fragments. The conceptual schemes developed in the separate areas of investigative analysis seem to bear little or no relation to each other. Specialists in each narrowly prescribed field of research have their own vocabulary and speak a language that can scarcely be comprehended by others. The need for synthesis and integration among the sciences is urgent.

It is not enough for geologists to borrow techniques and apparatus from the physicists in order to engage in geophysical research. Or for biologists to equip themselves with the paraphernalia of the chemist's laboratory and announce that they are biochemists. Synthesis and integration must be sought at a much deeper level. Truly integrative science will seek basic concepts that are valid in all the scientific compartments, conceptual schemes that tie together the disparate knowledge now displayed in academic showcases. Above all, it will make more clearly visible the unity of the universe and the fundamental nature of its orderliness.

This is especially important for men who want to live in a free society. Chaotic aggregations, although susceptible to statistical description, leave the individual unit under the domination of capriciousness. Freedom is a function of order, not of lawlessness. As it reveals the fundamental place of order in the universe, integrative science will validate the intuitive urge of man for freedom.

The politicians of America have a vital interest here. Educational procedures in our academic system have all too often stressed philosophically unrelated technical specialization. Practical competence has been inculcated, without an accompanying emphasis upon culture. There has been premature dependence upon science alone, and ethical values have been sadly neglected. All this has led to confusion, irresolution, demagogism, and the crippling of the democratic body politic. Science without conscience is in danger of leading us all to catastrophe.

Scientists also have a stake in the area of integra-

tive education. Not only must they accept responsibility for research along basic conceptual lines, but they must assist in the development of a climate of public opinion that recognizes the supreme worth of intellectual freedom. They must resist every effort to have education serve a society that maintains the symbols of political democracy, but actually concedes final control to covert concentrations of power that use educational skills to arrogate to themselves the administration of national welfare. Perhaps psychologists and psychiatrists might make their most valuable contributions in the next few years if they would concentrate their research, not on how to influence and manipulate people, but on how to free people from the compulsion to control others.

Less than one half of 1 per cent of the inhabitants of the United States are professionally engaged in scientific research, the technological application of its results, and the teaching of science. These scientists share the responsibility for human welfare with all other citizens. They cannot, however, escape the fact that because of their intellectual powers and their influence in forming public opinion, theirs is a larger share of that responsibility than their numbers alone would indicate.

Only those scientists who have both a social conscience and a large measure of courage will take the calculated risk of cultivating the common ground of science and politics. Knowing my colleagues as I do, I am confident that there are enough of them to make a powerful and beneficent impact upon public affairs in this country of ours, which even now has some claim to be "the land of the free and the home of the brave."

# Warren Weaver, AAAS President-Elect

**Chester I. Barnard**

*Chairman, National Science Foundation*

WARREN WEAVER, the new President-Elect of the AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, is director of The Rockefeller Foundation's Division of Natural Sciences and Agriculture. Elected at the Association's 119th meeting at St. Louis last December, Dr. Weaver will take office in 1954.

Dr. Weaver, who began his career with a strong interest in engineering and mathematical physics, was born in Reedsburg, Wisconsin, on July 17, 1894. From the University of Wisconsin he received a B.S. degree in 1916 and the degree of civil engineer in the following year. His early teaching experience at Throop College and the California Institute of Technology was interrupted by service as a second lieutenant in the U. S. Army Air Service from 1917 to 1919. In 1920 Dr. Weaver returned to his alma mater as assistant professor of mathematics completing his doctoral dissertation on electromagnetic theory and receiving the Ph.D. in 1921. Four years later he was promoted to the rank of associate professor, and in 1928 he became a full professor and chairman of the Department of Mathematics. During this period Dr. Weaver's published research, as well as his graduate teaching, was largely concerned with electrodynamics and diffusion theory. To Charles S. Slichter and Max Mason, with whom he was closely associated at this time, Dr. Weaver gives credit for directing him into his chosen specialty. With Professor Mason he collaborated in writing *The Electromagnetic Field,* in 1929. Four years earlier he was co-author with Charles S. Slichter of *Elementary Mathematical Analysis.*

In 1932 Dr. Weaver was invited to succeed Herman A. Spoehr as director of the Natural Sciences Division at The Rockefeller Foundation in New York. Dr. Weaver also served (1932–37) as director for the Division of Natural Sciences of the General Education Board, another Rockefeller board which at that time became interested in strengthening science teaching in our Southern universities. In these capacities he has had unusually broad experience and contacts in science.

Called upon to return to his original interests in applied mathematics during World War II, Dr. Weaver directed government research projects in the Office of Scientific Research and Development. From July 1940 until December 1942 he served as chairman of Section D-2, the Fire Control Division, of the National Defense Research Committee, and from 1943 to 1946 as chief of the Applied Mathematics Panel, an organization of over 200 mathematicians and statisticians working on a wide variety of military problems.

As early as 1941 Dr. Weaver had served on an official scientific mission, under James Bryant Conant, to investigate British weapons development. For his outstanding services in connection with the development of antiaircraft fire-control devices (prediction computers and controlling servomechanisms) and of bombsights and computing sights for use in air-to-air combat Dr. Weaver in 1948 received the Medal for Merit, the highest award made to civilians in the United States. He was also decorated with the King's Medal for Service in the Cause of Freedom by the