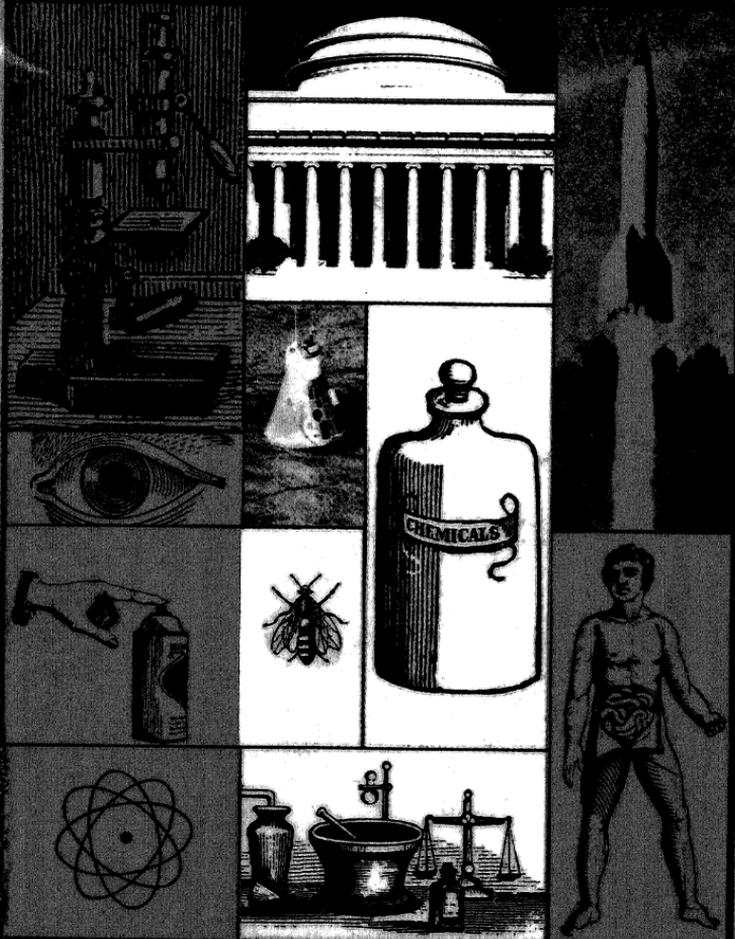


SCIENCE A. HUNTER DUPREE IN THE FEDERAL GOVERNMENT

A HISTORY OF POLICIES AND ACTIVITIES TO 1940



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A. Hunter Dupree



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PREFACE

THE aim of this study is to trace the development of the policies and activities of the United States government in science from the establishment of the federal Constitution to the year 1940. To produce a rounded synthesis, I have been forced to enter many fields of science that I could not possibly know thoroughly, and to describe many government agencies whose internal histories I could not examine completely. Although this invasion may dismay some devoted scientists and administrators, they should remember that mastery of their specialty could have been purchased only at the expense of other sections. If this study serves as a guide and a stimulus to those best qualified to preserve the history of their own activities, it will have fulfilled a part of my hopes for it.

This subject is only one of a number which must be explored before the relations of science to society in America are placed in proper perspective. The history of science in the United States is still largely unwritten. A real comparison between the experiences of the United States government with those of other countries would require studies in Europe which are yet to appear. Until such comparisons can be made, generalizations must be fragmentary. The story of the changing relation between science and technology is by no means completely reconstructed. Although the temptation has been great to attack these pressing questions, I have felt that this study could not answer them all at once. I hope that a faint trail through the wilderness will encourage others to attack it with the confidence that much remains to be learned.

Even more than is usual, this book is the product of coöperation among many institutions and individuals. I am aware of my obligation to more people than I can possibly list in this acknowledgment. I am happy, however, to mention a few of them.

Dr. Leslie H. Fishel, Jr., as research associate and consultant, contributed greatly to the project by his professional services. He did the research on a number of specific subjects and also discussed with me every major problem and interpretation. Since he was familiar with the research notes, his reading of the manuscript resulted in innumerable constructive comments.

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The National Science Foundation provided the initial impulse for the project and paid its expenses by means of a grant. During my periods of research in Washington, the Foundation allowed me the use of many facilities and gave me every attention that might conceivably help me. At the same time, I have not been an employee of the Foundation and have been left free to exercise my independent judgment at all times. I am personally grateful especially to Mr. Charles G. Gant and to his successor, Dr. John C. Honey, who have had immediate cognizance of the study.

The American Academy of Arts and Sciences of Boston and Cambridge, Massachusetts, has sponsored the project, taking the responsibility under the grant from the National Science Foundation. The many details of administration and local arrangements have been cared for through the American Academy. I am especially indebted to Mr. Ralph W. Burhoe, the executive officer.

The advisory committee, consisting of Professors I. Bernard Cohen, chairman, Edward C. Kirkland, William F. Ogburn, Arthur M. Schlesinger, Sr., and Richard H. Shryock, has been throughout a source of aid and inspiration. The members of the committee have all given the manuscript a critical reading, bringing to it their accumulated experience.

At Harvard University, I am particularly indebted to Dr. Keyes D. Metcalf, Director of Libraries, for office space as well as for the use of the great library resources of the University, without which this study would have been difficult if not impossible. I am grateful to Professor Reed C. Rollins for many courtesies at the Harvard University Herbarium.

My staff has been a source both of invaluable aid and of great satisfaction throughout the life of the project. Miss Elizabeth Cook has performed routine secretarial drudgery and intricate research with the same care and intelligence. Her service has been an essential factor in completing this book, especially within the narrow limits of time allowed.

At the National Archives I enjoyed guidance by Dr. Nathan Reingold, who generously placed at my service his detailed knowledge of relevant documents.

A number of busy people have freely given their time to me in interviews on specific subjects. I wish especially to mention Dr. Allen V. Astin, Dr. Vannevar Bush, Mr. Charles Campbell, Mr. Watson

Davis, Mr. P. J. Federico, Dr. Arno C. Fieldner, Dr. A. Remington Kellogg, Dr. Waldo G. Leland, Dr. Thomas G. Manning, Mr. Ernest G. Moore, Dr. Edwin B. Wilson, and Dr. Raymund L. Zwemer.

Despite assistance from so many sources, sole responsibility for the work is mine, including the conclusions and interpretations and any errors which may have escaped my vigilance.

For permission to quote copyrighted material I am indebted to Harcourt, Brace and Company, Inc., for quotations from Gifford Pinchot, *Breaking New Ground*; to J. B. Lippincott Company for quotations from W. H. Dall, *Spencer Fullerton Baird*; to Prentice-Hall, Inc., for quotations from Robert A. Millikan, *Autobiography*; to Charles C Thomas, Publisher, and to the author for quotations from John F. Fulton, *Harvey Cushing: A Biography*. Dr. Clifford K. Shipton, Custodian of the Harvard University Archives, granted permission for the use of letters in the Benjamin Peirce Papers.

I wish also to thank my wife, who has lived with this project as long as I have.

A. HUNTER DUPREE

Cambridge, Massachusetts
June 21, 1956

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I

FIRST ATTEMPTS TO FORM A POLICY

1787-1800

SINCE World War II the relation of science to the United States government has received ample recognition as a problem of profound national importance. The atomic bomb and the hydrogen bomb are only the most dramatic of the many symptoms of this dynamic factor in national life. The government has emerged as a great user of science and a great support to many lines of research. On the other hand, all the institutions of the country in which science exists have found that the actions of the government in conducting research and in contracting for it are factors of first importance. As an integral part of military power, science is recognized as a necessity for the nation's survival.

Since 1940, when most government administrators and scientists first became aware of the magnitude and complexity of their mutual relations, a vast literature has reflected new interest in the subject and widespread emphasis on its momentous implications. Running through this outpouring of contemporary writing is a theme — sometimes explicit but usually implied, as if the authors sensed rather than analyzed its presence — that science is not a new thing in the federal government. Nearly everyone can recall a few examples of activity in some federal bureau long before 1940. A few even have felt that these had more importance than mere isolated anticipations of current problems. But the great record of science in the government, as a living body of experience on which the present could build, has lain so scattered that few have appreciated either the extent or the meaning of the relation.

From the beginning the federal government has rendered honor to science and profited from it. Almost as early, the support given by the government was a significant source of strength to science in America. The institutions that grew up in and near the federal struc-

ture have been prominent in all periods of the nation's history. Indeed, before the rise of the universities, private foundations, and industrial laboratories, the fate of science rested more exclusively with the government than it did later.

All this historical experience with science was an asset in the crises after 1940. But to the development of American civilization it has a more profound significance. Science has been a formative factor in making both the federal government and the American mind what they are today. The relation of the government to science has been a meeting point of American political practice and the nation's intellectual life. This conjunction has been continuous from 1787 onward and has interacted with both contributors. On the one hand, American democracy's very essence has been influenced by the presence of science. On the other, the institutions that harbored and fostered science in America would have been different, and much poorer, without the efforts of the government spread over many decades. The resulting picture gives an additional dimension to American history.

Across the century and a half beginning with the Constitutional Convention, science has meant different things to each successive age, and at any time it has meant different things to a wide variety of groups. It is the interplay among these various concepts, not a logical choice of only one of them, which provides the full historical definition of science. In practical terms, this story is concerned with the natural sciences — physics, chemistry, biology — in all their specialties and variations. Since the emphasis is on the institutional setting, science here means education, communication, and organization as well as the creation of new knowledge by means of research. It also includes the growing and changing profession of the scientist. The social sciences have generally followed so different a path and chronology for entering the government that they deserve a fuller treatment on their own merits than they could get under the shadow of the older disciplines. Sometimes, however, the natural and the social sciences have grown up closely intertwined. Here the institution, not an arbitrary line, determines the boundary.

The distinction between basic or fundamental science and applied science is much too useful to avoid, but it must be made only with the understanding that the terms represent two ends of a continuous spectrum, with innumerable shadings in between. The term "develop-

ment," so common in the mid-twentieth century, has little usefulness through the several generations that did not employ it, although the concept behind it put in an early appearance.

Since World War I, science has become dominant in generating and directing changes in technology. In earlier years, however, the relations between science and a trial-and-error technology were sporadic, with practice influencing theory more often than the reverse. This story includes a consideration of technology to the extent that it is directly related to science.

As the history of the republic unrolled in the years down to 1940, scientific institutions within the government gradually solidified into a permanent establishment, the unsuccessful and abortive making their mark along with the rest. And the ideas behind them were quite as important as the actual organizations. Hence this is a story both of institutions and of ideas. Because the federal government provided the setting, ideas tended to become policies. Through all the twists and turns of the political history of the United States, and through the immense changes wrought by 150 years of rapidly expanding scientific knowledge, the policies and activities of the government in science make a single strand which connects the Constitutional Convention with the National Science Foundation.

The idea that the federal government should become the patron of science was easily within the grasp of the framers of the Constitution. As educated men of the eighteenth century they knew that European governments had often supported science, and their set of fundamental values led them to hold all branches of philosophy in high regard. Hence, as they went about their political task of reconciling the great interests of the new nation, they gave some consideration to the constitutional position of science in the government they envisaged. The problem was even more important than the setting up of some specific research activity, for it involved the whole later constitutional mandate for the government in science.

The Constitutional Convention

The framers had among them one of the great scientific men of the time in Benjamin Franklin, and, if he said nothing on the subject, others came forward with proposals that would have placed beyond argument the new government's duty and ability to encourage learn-

ing in both the arts and the sciences. Charles Pinckney's plan included power to "establish seminaries for the promotion of literature and the arts and sciences," to "grant charters of incorporation," to "grant patents for useful inventions," and to "establish public institutions, rewards and immunities for the promotion of agriculture, commerce, trades, and manufactures."¹ Had these provisions reached the final document, a national university devoted to advanced scientific training, societies chartered by the government, technical schools, and prizes and direct subsidies for creative effort could all have become realities — symbols that enlightenment was the first glory of a free republic. James Madison's proposals more succinctly called for the power to establish a university and to "encourage by premiums and provisions, the advancement of useful knowledge and discoveries."²

From these suggestions the committee of detail extracted most of the pith, reporting out only a clause for patents. Since science itself was not challenged by these cultivated men, the difficulties of a national university or of federal charters for societies stemmed from larger issues of more immediate concern than pure learning. These became clear in the convention's closing debates, which centered around a concept of great importance in the early history of the republic. "Internal improvements" were public works of all sorts. They might equally be roads and canals or universities and scientific societies. Whatever their object, internal improvements financed by the federal government were major political issues, and their fortune determined the degree to which science was supported.

The states naturally retained full freedom of action in this field, but the question of whether the federal government should participate had a special urgency because the very success of so large a union might well depend on the efficiency of the transportation system. When Dr. Franklin moved to add a power "for cutting canals where deemed necessary," he was speaking as a representative of the large state of Pennsylvania for strong action by the central government in all sorts of internal improvements. Objections immediately came from Roger Sherman of Connecticut, representing the small states and a restricted view of the powers of the central government. Madison then tried to return to his earlier idea of granting charters of incorporation "to secure an easy communication between the States," which immediately aroused the apprehension of those who feared powerful central organizations. But they suggested banks, not obser-