THE FRAGILE CONTRACT

University Science and the Federal Government

edited by

DAVID H. GUSTON AND KENNETH KENISTON

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Acknowledgments

This volume grew out of a faculty workshop at the Massachusetts Institute of Technology (MIT) on the relationship between scientific research universities and the federal government. The workshop brought a wide range of speakers together with a group of senior MIT faculty members and administrators, many of whom were charged with negotiating, maintaining, and improving just the sorts of relationships between science and politics that were being addressed.

The format of the workshop was intended to encourage extensive interaction. Each speaker's talk was distributed to the participants in advance of the meetings, held monthly during academic year 1991–1992, often accompanied by additional readings. The workshops started at 5 p.m. Before dinner, the speaker summarized his or her paper, and discussion focused on questions of fact. After dinner, one of the regular workshop participants reopened discussion with prepared comments. The ensuing two hours were more like an extended conversation than a formal question-and-answer period, with lively and sometimes heated exchanges with the speaker and among workshop members. A detailed summary of the discussion was used by the speakers to help prepare the final versions of their papers for this volume. (The papers by Gerald Holton and by Peter Likins and Albert H. Teich were commissioned after the workshop.)

The editors have incurred many debts during the preparation of this volume. We gratefully acknowledge the support of the Carnegie

Corporation of New York and the Office of the Provost at MIT for providing funding for the workshops. Professor Sheila Widnall, then associate provost at MIT and presently Secretary of the Air Force, was instrumental in conceiving and encouraging the project.

MIT participants in the workshop included: Robert Birgenau (Dean of the School of Science and Professor of Physics), John C. Crowley (Special Assistant to the MIT President and Director of the MIT Washington Office), Richard de Neufville (Director of the Technology and Policy Program and Professor of Civil Engineering), Bernard J. Frieden (Ford Professor of Urban Studies and Planning), Jerome I. Friedman (Institute Professor, Physics), Morris Halle (Institute Professor, Philosophy and Linguistics), Nancy H. Hopkins (Professor of Biology), Henry D. Jacoby (William F. Pounds Professor of Management), Thomas H. Jordan (Head, Department of Earth Atmospheric and Planetary Sciences), Daniel S. Kemp (Professor of Chemistry), Kenneth Keniston (Andrew W. Mellon Professor of Human Development, Program in Science, Technology, and Society (STS)), Daniel Kleppner (Lester Wolfe Professor of Physics), Stephen J. Lippard (Professor of Chemistry), Kenneth R. Manning (Thomas Meloy Professor of Rhetoric), Marcia K. McNutt (Professor of Earth, Atmospheric and Planetary Sciences), Richard C. Mulligan (Associate Professor of Biology), Paul Penfield, Jr. (Head, Department of Electrical Engineering and Computer Science), Walter Rosenblith (Institute Professor, Electrical Engineering), Paul R. Schimmel (Professor of Biology), Phillip A. Sharp (Head, Department of Biology), Eugene B. Skolnikoff (Professor of Political Science), Alar Toomre (Professor of Mathematics), Sheila Widnall (Abby Rockefeller Mauze Professor of Aeronautics and Astronautics and Associate Provost), and Gerald N. Wogan (Director, Division of Toxicology). Charles M. Vest (President), Mark S. Wrighton (Provost), John M. Deutch (Karl Taylor Compton Professor of Chemistry), and Joel Moses (Dugald C. Jackson Professor of Computer Science and Engineering and Dean of the School of Engineering) were ex-officio members of the group. David H. Guston (Political Science and STS Program) was the rapporteur.

Judith Stein and Debbie Meinbresse in the office of the STS Program at MIT assisted in managing the workshops, as did the staff of the MIT Faculty Club, where the meetings were held. Wade

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Charles M. Vest became the fifteenth President of the Massachusetts Institute of Technology in 1990. Prior to that, he had served as Provost, Vice President for Academic Affairs, and Dean of Engineering at the University of Michigan. Dr. Vest's research interests are in the thermal sciences and the engineering applications of lasers and coherent optics.

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Introduction: The Social Contract for Science

David H. Guston and Kenneth Keniston

In the years following World War II, the United States developed a remarkable system for supporting scientific research. This system was founded on a vision of science as an "endless frontier" that could replace the physical frontier of the American West as a driving force for economic growth, rising standards of living, and social change (Bush 1990 [1945]). Scientific discoveries, it was hoped, would not only keep the United States the world's leader in military technology but would also create an endless stream of new commercial products, new medical technologies, and new sources of energy that would eventually benefit all people. The institutions and practices created to support the system were a unique blend of public and private enterprises, eventually including a set of national biomedical laboratories at the National Institutes of Health (NIH), a set of military research and development (R&D) centers such as Los Alamos and Lawrence Livermore National Laboratories, mission agencies with special technological goals such as the National Aeronautics and Space Administration (NASA), and even a National Science Foundation (NSF) to give grants to scientists at public and private research universities.

In many ways, the research universities have been at the intellectual center of this entire enterprise, since it is there that most of the basic science research has been done. At the heart of federal support for universities has been the practice of competitive, peer-reviewed grants. The goal of peer review is simple: Identify the best research as defined by the scientists themselves. And the bargain

struck between the federal government and university science—what we call the "social contract for science"—can be summarized in a few words: Government promises to fund the basic science that peer reviewers find most worthy of support, and scientists promise that the research will be performed well and honestly and will provide a steady stream of discoveries that can be translated into new products, medicines, or weapons.

Whether measured in terms of people, products, patents, publications, or prizes, the American system of science has been the most successful in the world. Almost five decades into the social contract for science, however, there are signs that its pattern of partnership and harmony has eroded. It may well be, as the chapters in this volume suggest, that there was never a real "golden age" in the relationship between the federal government and the scientific community. Nevertheless, it is clear that the contract between science and society is undergoing a rethinking such as it has not experienced since its inception.

A Crisis in Science Policy?

In the late 1980s and early 1990s, conflicts between science and government have increased in number and noise. From Washington has come a slew of painful accusations about scientific research in the universities. Congressional committees have investigated cases of alleged scientific fraud and claims that federal funds had been spent by research institutions for liquor, yachts, and even (the supreme irony) lawyers to defend themselves against federal lawsuits. Some members of Congress have argued that the openness of American universities to foreign researchers and students allows our economic competitors to steal scientific and technical secrets whose development has been funded by U.S. taxpayers for the express purpose of competing in the international marketplace.

Attempts have been made to portray scientists (or at least the institutions in which they work) as generally greedy and selfish in their unending quest for new funds, as witnessed by their unwillingness to set priorities and their constant complaining when requests for funding are denied. University scientists are also attacked for supposedly neglecting teaching and research in order to enrich

themselves through consulting relationships and spinoff corporations. Throughout all of these accusations runs the implication that academic scientists have become arrogant and self-indulgent, rejecting legitimate oversight of the use of public money, claiming "entitlement" to ever-escalating funding, and unwilling to share responsibility for dealing with the growing deficits, trade imbalances, and other economic ills of their country.

The complaints voiced by the scientific community about government are scarcely less vehement. Congress and the executive branch stand accused of intruding into the conduct of science itself, attempting to "micromanage" scientific investigations, confusing honest mistakes with fraud, and subjecting distinguished scientists to humiliating and often ignorant cross-examination.

Far from being overindulged, many scientists claim, they are underfunded. A smaller proportion of research proposals are now being approved than in the past; outstanding researchers must waste time applying for multiple grants because so many requests to federal funding agencies are refused. Far from supporting luxuries and frills, federal grants for the indirect costs of scientific research do not even provide adequate compensation for the basic costs of running a research institution. Moreover, federal funding of research is often so delayed, or so laced with constraints, that responsible financial planning has become increasingly difficult for the research universities.

Other scientists believe that the growing congressional practice of "earmarking" R&D funds (specifying the precise institution or region to which funding should be given) is undermining the entire system of merit-based, peer-reviewed support that has made American science the envy of the world. And not least of all, academic administrators complain that onerous reporting requirements imposed upon applicants by the federal government require vast, expensive, and unproductive administrative staffs to assure that every requirement, no matter how trivial or unreasonable, is fully complied with.

The current situation in science and technology policy thus shows some signs of a conflict in which each side publicly attacks the motives of the other and expresses fear for the continuity of its own

values. Indicative of this atmosphere of apparent crisis is the sheer volume of printed analyses, reports, recommendations, and suggestions (a sampling would include OTA 1991; Carnegie Commission 1992; GUIRR 1992; NSB 1992; and U.S. Congress 1992).[1]

Despite all these analyses, the underlying causes of the current conflict between government and science have not been evident, nor have definitive assessments of its significance been made. Is an increasingly selfish and arrogant scientific community to blame? Or have politicians bent on personal aggrandizement torn down science in order to build themselves up? Are the recent controversies simply passing waves on the always tumultuous sea of public policy, or are they reflections of new political trends, new scientific directions, and newly emerging structures? Has the maw of the federal budget deficit been devouring science and technology funding, or is science peculiar in its need for more funds and ever-larger projects?

In short, is there a "crisis" in science and technology policy in the United States?

Most recent public discussion has focused on the more spectacular controversies of the past few years. In this book, we aim instead at a middle level of analysis, moving away from specific cases to address more general questions about the nature of the current relationship between politics and science. Our goal is to clarify both the constant elements and the new variables in that relationship.

Science practice and science policy are, of course, part of a larger social and political context, and controversies within science policy are inevitably linked to broader national trends and controversies. In the end, we do not believe that the current controversies between science and politics are indicative of a new or terminal "crisis" in science policy, at least not if "crisis" implies a discontinuous transition from something familiar into something unrecognizable. In this introduction, we argue instead that, given the inevitable stresses on political institutions and on the research enterprise, what keeps the turmoil from becoming a true crisis is the continuing contract between science and society, however fragile it may be.

The Social Contract between Government and Science

A Useful Metaphor

The idea of a social contract is commonly invoked to describe the relations between the communities of science and government. Sometimes termed a "tacit contract" or a "social contract for science," this metaphor is rooted in the actual contracts that establish the relationships between the federal government and scientists (see, e.g., Price 1954) as well as in the metaphorical contracts that bind and unite professional communities like that of scientists. In the language of science policy, the "social contract for science" refers above all to the constitution of the post–World War II research system on the blueprint outlined by two reports: Vannevar Bush's *Science: The Endless Frontier* (1990 [1945]) and John R. Steelman's *Science and Public Policy* (1947).

The metaphor of the contract is useful for several reasons. A contract implies two distinct parties, each with different interests, who come together to reach a formal agreement on some common goal. Implicit, too, is the notion that a contract is negotiated, arrived at through a series of exchanges in which each party tries to secure the most advantageous terms. A contract, moreover, suggests the possibility of conflict—or at least disparity of interests. For example, we do not usually make contracts with ourselves or with our immediate family; when we do, as with prenuptial agreements, they acknowledge the possibility of potential future conflicts. Finally, contracts can be renegotiated if conditions change for either party.

In contemporary usage, the contract metaphor also suggests the privileged treatment of the science community by government. Representative George Brown (D-CA) writes:

> Science and the technology that it spawns are viewed as a cornerstone of our past, the strength of our present, and the hope of our future. An unofficial contract between the scientific community and society has arisen from these beliefs. This contract confers special privileges and freedoms on scientists, in the expectation that they will deliver great benefits to society as a whole. (1992: 781)