OFFICE OF FEDERAL PROCUREMENT POLICY ACT AMENDMENTS OF 1979

59-139 O - 79 (87)

Public Law 96-83
96th Congress

An Act

Oct. 10, 1979
[S. 756]

To amend the Office of Federal Procurement Policy Act, and for other purpos

Be it enacted by the Senate and House of Representatives of t United States of America in Congress assembled,

Office of Federal Procurement Policy Act Amendments of 1979.
41 USC 401 note.

SHORT TITLE; REFERENCE

SECTION 1. (a) This Act may be cited as the "Office of Feder Procurement Policy Act Amendments of 1979".

41 USC 401 note.

(b) As used in this Act, the term "the Act" means the Office Federal Procurement Policy Act.

DECLARATION OF POLICY

SEC. 2. Strike Section 2 of the Act (41 U.S.C. 401) and insert in li thereof the following:

"DECLARATION OF POLICY

"SEC. 2. It is declared to be the policy of Congress to promo economy, efficiency, and effectiveness in the procurement of proper and services by and for the executive branch of the Federal Gover ment by—

"(1) promoting the use of full and open competition in tl procurement of products and services;

"(2) establishing policies, procedures, and practices which w require the Government to acquire property and services of tl requisite quality and within the time needed at the lowe reasonable cost;

"(3) improving the quality, efficiency, economy, and perforr ance of Government procurement organizations and personne and eliminating fraud and waste in the procurement proces

"(4) avoiding or eliminating unnecessary overlapping or dupl cation of procurement and related activities;

"(5) avoiding or eliminating unnecessary or redundant requir ments placed on contractor and Federal procurement official

"(6) identifying gaps, omissions, or inconsistencies in procur ment laws, regulations, and directives and in other laws, regul tions, and directives, relating to or affecting procurement;

"(7) achieving greater uniformity and simplicity, whenev appropriate, in procurement procedures;

"(8) otherwise promoting economy, efficiency, and effectiv ness in Government procurement organizations and operatio

"(9) coordinating procurement policies and programs of tl several departments and agencies;

"(10) minimizing possible disruptive effects of Governmer procurement on particular industries, areas, or occupation

"(11) improving understanding of Government procuremer laws and policies within the Government and by organizatior and individuals doing business with the Government; and

"(12) promoting fair dealing and equitable relationships amon the parties in Government contracting.".

DEFINITION

SEC. 3. Section 4 of the Act (41 U.S.C. 404) is amended by inserting "(a)" immediately after "SEC. 4." and by inserting at the end of such section the following new subsection: 41 USC 403.

"(b) As used in this Act, the term 'procurement' includes all stages of the acquisition process, beginning with the process for determining a need for property and services through to the Federal Government's disposition of such property and services.".

AUTHORITY AND FUNCTIONS

SEC. 4. (a) Section 6(a) of the Act (41 U.S.C. 405(a)) is amended to read as follows:

"SEC. 6. (a) The Administrator shall provide overall leadership in the development and implementation of procurement policies and the coordination of programs to improve the quality and performance of procurement personnel. The Administrator shall develop for submission under section 8(a) a uniform procurement system which shall, to the extent he considers appropriate and with due regard to the program activities of the executive agencies, include uniform policies, regulations, procedures, and forms to be followed by executive agencies—

Uniform procurement system. 41 USC 407.

"(1) in the procurement of—

"(A) property other than real property in being;

"(B) services, including research and development; and

"(C) construction, alteration, repair, or maintenance of real property; and

"(2) in providing for procurement by recipients of Federal grants or assistance of items specified in clauses (1)(A), (1)(B), and (1)(C) of this subsection, to the extent required for performance of Federal grant or assistance programs.".

(b) Section 6(c) of the Act (41 U.S.C. 405(c)) is amended to read as follows:

"(c) The Administrator shall develop and propose a central management system consisting of the Office of Management and Budget, the General Services Administration, and procurement offices in executive agencies to implement and enforce the uniform procurement system described in subsection (a) of this section.".

Central management system.

(c) Section 6(d) of the Act (41 U.S.C. 405(d)) is amended to read as follows:

"(d) The functions of the Administrator shall include—

"(1) reviewing the recommendations of the Commission on Government Procurement to determine those recommendations that should be completed, amended, or rejected, and to propose the priority and schedules for completing the remaining recommendations;

"(2) developing a system of simplified and uniform procurement policies, regulations, procedures, and forms;

"(3) establishing criteria and procedures for an effective and timely method of soliciting the viewpoints of interested parties in the development of procurement policies, regulations, procedures, and forms;

"(4) promoting and conducting research in procurement policies, regulations, procedures, and forms, through the Federal Acquisition Institute, which shall be located within the Office and directed by the Administrator;

"(5) establish, through the Federal Procurement Data Center, which shall be located in the General Services Administration and acting as executive agent for the Administrator, a comput based information system for collecting, developing, and disser nating procurement data which takes into account the needs the Congress, the executive branch, and the private sect

"(6) recommending and promoting, through the Federal Acq sition Institute, programs of the Office of Personnel Manageme and executive agencies for recruitment, training, career devel ment, and performance evaluation of procurement personn

41 USC 407.

"(7) developing, for inclusion in the uniform procureme system to be submitted under section 8(a), standard contracts a contract language in order to reduce the Government's cost procuring goods and services as well as the private sector's cost doing business with the Government; and

"(8) providing leadership and coordination in the formulati of executive branch positions on legislation relating procurement.".

(d) Section 6(e) of the Act (41 U.S.C. 405(e)) is amended to read follows:

Consultation with executive agencies.

"(e) In the development and implementation of the uniform p curement system the Administrator shall consult with the executi agencies affected, including the Small Business Administration a other executive agencies promulgating policies, regulations, pro dures and forms affecting procurement. To the extent feasible, t Administrator may designate an executive agency or agencies, esta lish interagency committees, or otherwise use agency representativ or personnel to solicit the views and the agreement, so far as possib of executive agencies affected on significant changes in polici regulations, procedures and forms.".

(e) Section 6 of the Act (41 U.S.C. 405) is further amended inserting at the end thereof the following new subsections:

"(h)(1) Until the effective date of legislation implementing a u form procurement system, the Administrator may, with the conc rence of the Director of the Office of Management and Budget, iss policy directives, in accordance with existing law, for the purpose promoting the development and implementation of the unifor procurement system or for the purpose of promoting the policies s forth in paragraphs (1) through (8) of section 2 of this Act. Such poli directives shall be followed by executive agencies.

"(2) Any policy directives issued pursuant to paragraph (1) m require executive agencies to issue implementing regulations whi shall be in accord with the criteria and standards set forth in su policy directives.

Regulations, denial or rescission of promulgation.

"(i) Until the effective date of legislation implementing a unifor procurement system, the Director of the Office of Management a Budget shall deny or rescind the promulgation of any final rule regulation of any executive agency relating to procurement if t Director determines that such rule or regulation is inconsistent wi the policies set forth in paragraphs (1) through (8) of section 2 of th Act or is inconsistent with any policy directives issued pursuant subsection (h).

"(j) Nothing in this Act shall be construed—

"(1) to impair or affect the authorities or responsibiliti conferred by the Federal Property and Administrative Servic

40 USC 471 note.

Act of 1949 with respect to the procurement of automatic da processing and telecommunications equipment and services or real property; or

"(2) to limit the current authorities and responsibilities of t Director of the Office of Management and Budget.".

RESPONSIVENESS TO CONGRESS

SEC. 5. (a) Section 8(a) of the Act (41 U.S.C. 407(a)) is amended to read as follows:

"SEC. 8. (a)(1) The Administrator shall keep the Congress and its duly authorized committees fully and currently informed of the major activities of the Office of Federal Procurement Policy, and shall submit a report thereon to the House of Representatives and the Senate annually and at such other times as may be necessary for this purpose. Report to Congress.

"(2) At the earliest practicable date, but in no event later than one year after the date of enactment of the Office of Federal Procurement Policy Act Amendments of 1979, the Administrator shall transmit to the House of Representatives and the Senate his proposal for a uniform procurement system. Such proposal shall include a full description of the proposed system, projected costs and benefits of the system as proposed, and short- and long-term plans for implementation of the system, including schedules for implementation. At the same time, the Administrator shall transmit a report on the recommendations of the Commission on Government Procurement specified in section 6(d)(1) of this Act. Uniform procurement system proposal, transmittal to Congress.

"(3) At the earliest practicable date, but in no event later than one year after presentation of the proposal described in paragraph (2) of this subsection, the Administrator shall propose to the House of Representatives and the Senate recommended changes in legislation relating to procurement by executive agencies. If the Administrator deems it necessary, these recommendations shall include a proposal for a consolidated statutory base for procurement by executive agencies. Executive agencies' procurement proposal, transmittal to Congress.

"(4) At the earliest practicable date, but in no event later than the submission of the legislative recommendations described in paragraph (3) of this subsection, the Administrator shall present a proposal for a management system described in section 6(c) to implement and enforce the uniform procurement system.". Management system proposal.

(b) Section 8 of the Act (41 U.S.C. 407) is further amended—

(1) by striking out "any major policy or regulation prescribed under section 6(a)" in subsection (b) and inserting in lieu thereof "any policy prescribed under section 6(h)"; 41 USC 405.

(2) by striking "or regulation" each place it appears in such subsection; and

(3) by striking out "any major policy or regulation" in subsection (c) and inserting in lieu thereof "any policy".

EFFECT ON EXISTING REGULATIONS

SEC. 6. Section 10 of the Act (41 U.S.C. 409) is amended to read as follows:

"EFFECT ON EXISTING REGULATIONS

"SEC. 10. Procurement policies, regulations, procedures, or forms in effect as of the date of enactment of the Office of Federal Procurement Policy Act Amendments of 1979 shall continue in effect, as modified from time to time by the issuing offices on their own initiative or in response to policy directives issued under section 6(h) until repealed, amended, or superseded pursuant to the adoption of the uniform procurement system described in section 6 of this Act.". 41 USC 405.

AUTHORIZATION OF APPROPRIATIONS

SEC. 7. Section 11 of the Act (41 U.S.C. 410) is amended—

(1) by striking out the first sentence and inserting in lie thereof the following: "There are authorized to be appropriate to carry out the provisions of this Act, and for no other purpose $4,000,000 for the fiscal year ending September 30, 1980, and fo each of the three succeeding fiscal years; and one-third of th funds appropriated for any such fiscal year shall be mad available to the Federal Acquisition Institute for the perform ance of its functions under this Act."; and

(2) by striking out "Government Operations" in the secon sentence and inserting in lieu thereof "Governmental Affairs"

DELEGATION

SEC. 8. Section 12(a) of the Act (41 U.S.C. 411(a)) is amended b striking out "direction of Federal procurement policy and to pre scribe policies and regulations to carry out that policy" and b inserting in lieu thereof "leadership in the development of Federa procurement policy".

ACCESS TO INFORMATION

SEC. 9. Section 14(b) of the Act (41 U.S.C. 412(b)) is amended b striking out "establishing" and inserting in lieu thereo "developing".

CONFORMING AMENDMENTS

SEC. 10. (a) Sections 201(a)(1), 201(c), and 206(a)(4) of the Federa Property and Administrative Services Act of 1949 (40 U.S.C. 481(a)(1) 481(c), 487(a)(4)) are each amended by striking out "subject to regula tions" and inserting in lieu thereof "subject to policy directives"

(b) Section 602(c) of the Federal Property and Administrative Services Act of 1949 (40 U.S.C. 474(c)) is amended by striking ou "except as otherwise provided by the Office of Federal Procuremen

41 USC 401 note. Policy Act, and".

EFFECT ON OTHER LAW

41 USC 405a note.

SEC. 11. The provisions of the Act as amended by this Act shal supersede the provisions of section 222 of the Act of October 24, 1978 entitled "An Act to amend the Small Business Act and the Smal

92 Stat. 1771.

Business Investment Act of 1958" (41 U.S.C. 405a) to the extent they are inconsistent therewith.

EFFECTIVE DATE

41 USC 401 note.

SEC. 12. Except to the extent otherwise provided therein, the amendments made by this Act shall take effect on October 1, 1979.

Approved October 10, 1979.

LEGISLATIVE HISTORY:

HOUSE REPORT No. 96-178 accompanying H.R. 3763 (Comm. on Government Operations).
SENATE REPORT No. 96-144 (Comm. on Governmental Affairs).
CONGRESSIONAL RECORD, Vol. 125 (1979):
May 21, considered and passed Senate.
Sept. 10, H.R. 3763 considered and passed House; passage vacated and S. 756, amended, passed in lieu.
Sept. 27, Senate concurred in House amendments with amendments.
Sept. 28, House agreed to Senate amendments.
WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS, Vol. 15, No. 41:
Oct. 10, Presidential statement.

[COMMITTEE PRINT]

Union Calendar No. 000

89th Congress, 1st Session - - - - - House Report No. 1158

CONFLICTS BETWEEN THE FEDERAL RESEARCH PROGRAMS AND THE NATION'S GOALS FOR HIGHER EDUCATION

REPORT

BY THE

COMMITTEE ON GOVERNMENT OPERATIONS

SEPTEMBER —, 1965.—Committed to the Committee of the Whole House on the State of the Union and ordered to be printed

U.S. GOVERNMENT PRINTING OFFICE

52-569 WASHINGTON : 1965

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LETTER OF TRANSMITTAL

House of Representatives,
Washington, D.C., September —, 1965.

Hon. John W. McCormack,
Speaker of the House of Representatives,
Washington, D.C.

Dear Mr. Speaker: By direction of the Committee on Government Operations, I submit herewith the committee's ———— report to the 89th Congress. The committee's report is based on a study made by its Research and Technical Programs Subcommittee.

William L. Dawson, *Chairman.*

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[COMMITTEE PRINT]

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CONFLICTS BETWEEN THE FEDERAL RESEARCH PROGRAMS AND THE NATION'S GOALS FOR HIGHER EDUCATION

SEPTEMBER —, 1965.—Committed to the Committee of the Whole House on the State of the Union and ordered to be printed

Mr. DAWSON, from the Committee on Government Operations, submitted the following

REPORT

BASED ON A STUDY BY THE RESEARCH AND TECHNICAL PROGRAMS SUBCOMMITTEE

On September —, 1965, the Committee on Government Operations had before it for consideration a report entitled "Conflicts Between the Federal Research Programs and the Nation's Goals for Higher Education." Upon motion made and seconded, the report was approved and adopted as the report of the full committee. The chairman was directed to transmit a copy to the Speaker of the House.

I. WHAT ARE THE CONFLICTS?

Our Federal research programs, on the one hand, and the Nation's goals for higher education, on the other, are in increasing conflict. While both research and higher education share the common goals of extending scholarship and developing the intellectual resources of the Nation, the immediate interests of one are not necessarily those of the other.

The first conflict is in the present use of scarce manpower. Scientists and engineers are indispensable to research and development. They are also indispensable as teachers in the expanding higher education system. Since their numbers cannot be greatly increased over the short run, too much diversion into the one means deprivation of the other.

The second is a conflict between present use of manpower resources, and investment for future manpower resources. Both programs gain eventually from a greater investment in education and training of future scientists and engineers. But research demands *performance* now; investment to train manpower is necessarily of secondary concern. Education by its nature demands *investment* now in training young people so that the Nation can have the benefits of performance later. Short-term research requirements may be satisfied by concentrating most of the science funds in a few excellent universities. But the longrun effects of such concentration could be disastrous for other colleges and universities and, hence, ultimately for both research and for higher education.

A third conflict arises because the demands of research and development are focused primarily in the natural sciences. But colleges and universities must transmit knowledge and encourage scholarship in all fields of learning, while maintaining a careful balance among the humanities, the social sciences, and the natural sciences.

The nature and extent of these conflicts must be understood if the Federal Government is to make headway toward the equally important goals of research and development, and higher education. Neither more money for research and development nor more money for higher education will alone assure more of either. Indeed, these actions, unaccompanied by Federal policies which balance the competing and sometimes conflicting needs of the two programs, will put them on a collision course and damage both.

A. Research and Development—A High Priority National Goal

Propelled by the Nation's evolving requirements in the defense, atomic energy, space, and health fields, the Federal Government has expanded annual obligations for research and development more than tenfold over the past two decades. From an annual level of about $1.5 billion in 1945, they now stand at an estimated $16.1 billion in fiscal 1965. No accurate figures are available on the Nation's total expenditure for research and development nor on the amounts spent by sectors of the economy other than the Federal Government. The National Science Foundation estimates, however, that the Federal Government accounts for about 65 percent of all spending for research and development; industry for about 32 percent: colleges and universities for about 2 percent; and nonprofit institutions for about 1 percent.[1]

Over $14 billion of current Federal commitments are those of the Department of Defense ($7.3 billion), the National Aeronautics and Space Administration ($5.4 billion), and the Atomic Energy Commission ($1.5 billion). Nearly half of the remaining $2 billion is committed by the Department of Health, Education, and Welfare.

For what purposes are the funds spent and who does the work? The $16.1 billion are distributed roughly $10 billion for development, $5.1 billion for applied and basic research, and about $1 billion for plant and major equipment required for these activities. Private industry is the major performer, accounting for nearly $10 billion of all research and development work. Of the remaining performers, the Federal Government itself and educational institutions (including research centers managed by them) are the most significant, accounting for $2.9 and $1.8 billion, respectively.

[1] Presented in testimony by the National Science Foundation before Subcommittee on Science, Research, and Development of the House Committee on Science and Astronautics, June 23, 1965.

The returns on these investments most readily grasped are those of applied science and technology. These vary from the large and dramatic to the small but highly significant over a wide and diverse area. They range from ballistic missiles in the Nation's defense armory to tiny transistors for use in a host of devices; from synchronous space satellites introducing a new age in communications to a rich array of new synthetic fibers and plastics; from nuclear reactors for the production of energy to polio vaccines which have all but eliminated a major disease; from computers and data processing machines to radioisotopes for aiding medical diagnosis and therapy.

Less obvious but no less enduring benefits can come from the stimulus which has been given basic research by the Federal investment in research and development. The Federal programs have engaged the efforts of a growing scientific community in a broad range of disciplines, extending from mathematics and the physical sciences to engineering and a wide area of the behavioral and life sciences. This pursuit of more understanding about man and the physical universe has been elevated to a position of unprecedented esteem; research work now plays a significant role in industry, in Government, and, of course, in its natural habitat, the colleges and universities. An environment has thus been established in which maximum encouragement is given for the fusing of superior minds and intensive study and investigation that sometimes happily results in major "breakthroughs" in scientific discovery. These will lay the foundation for future progress toward better health, greater security, and a higher level of welfare both at home and in the world community.

B. HIGHER EDUCATION—AN EQUALLY IMPORTANT NATIONAL GOAL

Throughout its history, the United States has placed a high value on education. It has been regarded as *the* motive force for dampening any tendencies to inherited privilege, lifting the economic and social status of the less advantaged, converting waves of immigrants into Americans within the span of a generation, and broadening the sources of ideas and talents, indispensable for the strength and vitality of democratic institutions.

As a result, there has been a steady advance in the educational level of the whole Nation. The percentage of high school graduates among 17-year-olds has risen from 2 percent in 1870, to 6.4 percent in 1900, 29 percent in 1930, 59 percent in 1950, and over 70 percent today. Among adults in the labor force, those 18 years old and over, 56 percent had completed 4 years of high school or more in 1964.

An even more impressive rise has taken place in higher education. The numbers enrolled in colleges and universities have increased from less than 250,000 persons in 1900 to around 5 million persons today. About 11 percent of all persons in the 1964 adult labor force had completed 4 or more years of college. U.S. attainments in higher education are unrivalled elsewhere in the world—in 1958 it was estimated that this country accounted for more than a third of world enrollments at the college level.[2]

[2] It should be recognized, of course, that the democratic traditions of U.S. higher education make segments of its higher education different from systems in countries with established influence of class or money. See, for example, testimony of Admiral Rickover, hearings before the Special Subcommittee on Education, U.S. House of Representatives, 89th Cong., 1st sess., on Higher Education Act of 1965, February–May 1965, p. 226.

This long-held commitment to education has now been reinforced by the President's proposal that "full educational opportunity" be declared a national goal. The words of his January 12, 1965, message to the Congress restate for the country its fundamental convictions:

> Every child must be encouraged to get as much education as he has the ability to take.
>
> We want this not only for his sake—but for the Nation's sake.
>
> Nothing matters more to the future of our country: not our military preparedness—for armed might is worthless if we lack the brainpower to build a world of peace; not our productive economy—for we cannot sustain growth without trained manpower; not our democratic system of government—for freedom is fragile if citizens are ignorant.
>
> We must demand that our schools increase not only the quantity but the quality of America's education. For we recognize that nuclear age problems cannot be solved with horse-and-buggy learning. * * *

Over the years following World War II, Congress, too, has been concerned to advance higher education.

From 1944 to 1958,[3] it approved a succession of "GI" bills authorizing payment of tuition fees and other costs for veterans of World War II and the Korean war wishing to continue their schooling. Some 3,475,000 veterans were thereby enabled to enroll in colleges and universities.[4]

In a series of actions beginning with the enactment of the National Cancer Institute Act in 1937, Congress authorized the Public Health Service and the National Institutes of Health to award fellowships and traineeships, both directly and through institutions of higher education, to graduate students in health-related science fields. Funds made available for these purposes rose from a mere $8,000 in fiscal 1938 to about $220 million in fiscal 1964. In the latter year, a total of 8,777 fellowships and traineeships were awarded.

In 1950, in establishing the National Science Foundation,[5] Congress charged the agency not only to promote basic research in the sciences but also "to strengthen * * * education in the sciences." Under this program of the Foundation, the number of graduate and postdoctoral students in the sciences receiving fellowships and traineeships rose from 575 in fiscal 1952 to an estimated 7,725 in fiscal 1965.[6]

In 1958, Congress approved the National Defense Education Act, setting forth a program of loans to students and graduate fellowships in science, mathematics, engineering, and modern foreign languages.[7] The act, amended in 1964 to apply to all fields of higher education,

[3] The first "GI" bill was passed in 1944 (58 Stat. 284) and the final one in 1958 (72 Stat. 1119).

[4] Report of the Select Committee on Government Research of the House of Representatives, 88th Cong., 2d sess., December 1964, "Federal Student Assistance in Higher Education," Study No. V, H. Rept. No. 1933, p. 4.

[5] 64 Stat. 149.

[6] Report of the Science Policy Research Division, Legislative Reference Service of the Library of Congress to the Subcommittee on Science, Research, and Development of the Committee on Science and Astronautics, U.S. House of Representatives, 89th Cong., 1st sess., "The National Science Foundation, a General Review of Its First 15 Years," 1965, p. 140.

[7] 72 Stat. 1580.

had by October 1964, assisted some 600,000 students through the loan program and added new fellowship awards at the rate of 1,000 to 1,500 per year.[8]

Under the college housing program of 1950,[9] Higher Education Facilities Act of 1963,[10] and the Health Professions Educational Assistance Act of 1963,[11] Federal assistance for construction of dormitories, classrooms, and other facilities has been provided.

Now, to give effect to the President's proposal to lift the Nation's sights on higher education, Congress is considering H.R. 9567, the Higher Education Act of 1965, a new program stressing scholarship grants for needy students, work-study arrangements, and low-cost guaranteed loans. If enacted, the proposed scholarship grants could assist as many as 130,000 students in the first year. Work-study arrangements, inaugurated under the Economic Opportunity Act and expanded under the proposed new act, could help an estimated 300,000 poor students. Thousands of others from middle-income families will benefit from lower-cost loans than are now available. In addition, H.R. 9567 proposes a 5-year program of grants, with an authorization of $30 million for fiscal 1966, to finance faculty-exchange and other cooperative programs between larger universities and small, weaker colleges; and to finance teaching fellowships for young scholars who wish to teach at such smaller colleges.

Also now before Congress is a proposal (H.R. 9460) to establish a National Arts and Humanities Foundation. Under this bill, $5 million would be authorized to support research and scholarship in the humanities during the first fiscal year to parallel the $479,999,000 approved for similar support of the natural sciences through the National Science Foundation in fiscal 1966.

These programs mainly have the effect of increasing demands on the higher education system at a time when unprecedented numbers are seeking admission to colleges and universities. Except by helping to add to the physical plant of educational institutions, the programs are not primarily directed toward increasing the capacity of the system to supply increased demands for higher education. In particular, they fail to take adequate account of the need for additional good teachers—an indispensable part of the capacity of the higher education system—without whom the new demands, including those resulting from Federal programs, cannot be met. H.R. 9567, the higher education bill now under consideration, is unique in its recognition that incentives will have to be provided to larger institutions to share faculty strength with smaller and weaker colleges and to attract young graduates into college teaching at poorer, smaller institutions.

C. The Research and Development Program Both Helps and Hurts Higher Education

Many educators, appalled by the ballooning demands for more, well-trained teachers in higher education, are critical of the growing emphasis on research among their faculties and graduate students. Scientists, as practitioners of research and beneficiaries of Federal

[8] 78 Stat. 1100.
[9] 68 Stat. 48, title IV.
[10] 77 Stat. 363.
[11] 77 Stat. 164.

programs, are prone to interpret criticism of these programs as lack of appreciation of research. Too much emotion and not enough light thereby characterize the dialog on the question.

The subcommittee is strongly of the conviction that the Government should not be just another participant in the debate at this level. It must sort out and weigh benefits and costs of the present Federal research programs for higher education; it should then revise research policies and practices in the light of the needs of both research and higher education.

The subcommittee finds that college enrollments are rising, and the shortage of teachers is becoming acute (ch. II); that Federal research and development programs have unquestionably improved scientific higher education in some particulars (ch. III); but that Federal research and development programs have harmed scientific higher education by excessively diverting scientific manpower from teaching, and by overemphasizing research to the detriment of teaching (ch. IV); by concentrating such programs in a way that is detrimental to science education in smaller institutions without yielding compensatory returns in the training of young scientists (ch. V); and by neglecting the social sciences and humanities (ch. VI). Our recommendations are made throughout these chapters.

II. COLLEGE ENROLLMENTS ARE RISING, AND THE SHORTAGE OF TEACHERS IS BECOMING ACUTE

A. Enormous Expansion in the Demand for Higher Education Is in Prospect

We are now in the midst of a period of rapidly accelerating demand for higher education. According to the Office of Education, an expanding population in the 18- to 21-year age group, with higher proportions of the age groups attending college, will boost current college enrollment estimates of less than 5 million in the 1964–65 school year to some 7 million by 1969–70. Instead of freshman classes at the 1 million level of the first years of this decade, the fall of 1965 will see an entering class exceeding 1,300,000, and first-year classes of 1,600,000 by 1970 are predicted.

These estimates may well understate the future demand for higher education. A more rapid rise in average family incomes; wider provision of scholarships for able students now kept out of college for financial reasons; faster movement of disadvantaged groups in the country toward the income and welfare standards of the rest of the community; and accelerated demands for professionally trained personnel, are some of the factors which could swell the numbers seeking admission to colleges and universities.

Even now, college attendance may be depressed by capacity limitations both of facilities and of teachers. Entrance and performance standards have been successively stiffened, not by any conviction that higher education should be only for the intellectual elite but simply for lack of room in locations where bright young people live. A professor at the University of Illinois recently charged that in the 1964–65 academic year, 6,000 fully qualified students had to be denied admission in Illinois for this reason.[12]

Also, current estimates seem widely at variance with the "revolution of rising expectations." A public opinion survey recently conducted by the Harris poll found that 99 percent of American parents with children of college age wanted their children to go to college. Currently, about 40 percent of college-age young people have this privilege.

Some of the 59 percent of the parents whose children do not now go to college are no doubt pitching their expectations higher than the capacities of their children warrant. And not all bright youngsters will want to go on to college. But it would be rash to conclude that given the opportunity and money, many more young people would not elect to get a college education.

The 1960 project talent study conducted by the University of Pittsburgh concluded that some 100,000 students ranking in the top one-third on national scholastic aptitude tests fail to go on to college because they lack the money.

[12] Andrew Schiller. Harper's. May 1965, pp. 87–94.

It is also instructive to compare the dropout rate at successive levels of family income. Among the top third of families, 83 out of 100 students entering high school reach the senior year, 78 graduate, and 55 enter college. In the middle group, 90 reach the senior year, 79 graduate, and 34 enter college. But in the lowest third, though 66 reach the senior year and 56 graduate, only 10 enter college.[13]

These are results based on the current quality of secondary education. Better education at the primary and secondary levels will produce a much larger crop of young people with the capacity to qualify for and benefit from higher education. Martin Mayer has described the success story of an imaginative teaching program undertaken at one of New York's worst junior high schools. In 7 years' time, the number of the school's graduates passing all courses in the first year of a stiff New York City academic high school program increased from 5 to nearly 80. One boy, judged in the beginning to have barely average capacity, went on to finish high school with honors and to get a $1,600 scholarship and a $500 job at Columbia University. Another, retarded in a number of respects at entry into junior high school, went on to obtain a $1,380 scholarship from New York University. Still another finished in the top 15 percent of the national College Entrance Board examinations and won a full scholarship to Amherst.[14]

B. A Critical Shortage of Teachers for Colleges and Universities Is Expected

To take care of the coming undergraduate student population estimated at what appear to be conservative levels, the Office of Education foresees huge inadequacies in teaching staffs. It estimates that to take care of an enrollment of 7 million in 1970, the full-time equivalent of instructional staff at colleges and universities will have to increase from 324,000 in the academic year 1964–65 to 437,000. Though the net increase required is, therefore, 113,000 instructors, many more will need to be recruited to replace those who die, retire, or go to other occupations. The Office of Education estimates that to have a net increase of 113,000 teachers, a total of 227,000 persons will need to enter (or reenter) college teaching by 1970. It further concludes that about 40 percent, or roughly 90,000, in this group should have doctorate degrees if teaching standards are to held at desired quality livels.[15]

How does the foreseeable supply of new doctorate degree holders compare with these needs? In the school year 1963–64, 14,490 Ph. D. degrees were awarded.[16] If the number of Ph. D. degrees awarded increases at the long-time average rate of 7 percent per annum (see chart I, p. 33), about 90,000 Ph. D. holders would be added in the 5-year period, 1965–69 inclusive. Under a much more optimistic assumption that the annual rate of increase could be boosted and held to 10 percent (achieved for a period as long as 5 years only once

[13] Allan Cartter: Paper on "Tax Reliefs and the Burden of College Costs," for the American Council on Education. Reprinted in U.S. Congress, hearings before Special Subcommittee on Education, House Committee on Education and Labor, 89th Cong., 1st sess., Higher Education Act of 1965, p. 52.

[14] "The Schools," the Bodley Head, London, 1961.

[15] Unpublished memorandum of the Higher Education Personnel Section of the Office of Education. This estimate appears conservative since a comprehensive study by the Office of Education of the faculty of all 4-year colleges as well as universities revealed that 51 percent of the faculty had doctorates in 1963.

[16] See footnote 69, p. 34.

since 1900, in the years 1925–30), the 5-year total would be about 97,000.

But even under the more optimistic assumption, nearly all future Ph. D.'s in the next 5 years would have to go into college teaching if desired standards of instruction are to be maintained in the period immediately ahead. In fact, the actual proportion of Ph. D.'s entering or remaining in college teaching is very much lower. Table I, based on data gathered by the National Education Association, shows that today in all fields of study, only about 48 percent of new doctorates go into college teaching.

Therefore, it appears that in the next 5 years, there will be a shortfall of close to 45,000 Ph. D.'s below the needed number. We shall have only about one-half of those we need.

This gloomy conclusion is, of course, subject to modification. A more intensive use by colleges and universities of those already holding doctorate degrees may be possible. This could occur as a result of higher retirement ages for those now teaching, additional employment of qualified women, a smaller outflow of teachers to competing occupations, or a larger inflow into college teaching from such occupations, or a combination of these.[17]

The Ph. D. shortage will be particularly felt in the sciences, in which opportunities other than college teaching abound for new Ph. D.'s. Table I shows that the 48-percent average going into college teaching is composed of highly disparate ratios among the disciplines. While two-thirds or more of all new Ph. D.'s in the arts, humanities, and social sciences go into college teaching, the highest ratio in the sciences is 66 percent for mathematics. Much lower ratios are the case in the rest of the sciences, from 41 percent for the biological sciences down to 29 percent and 23 percent for physics and chemistry, respectively.

TABLE I.—*Selected groups of doctor's degree graduates 1963 and 1964 in college teaching* [1]

	All graduates, number	In college teaching (total)	
		Number	Percent
All fields	22,269	10,772	48.4
English	885	784	88.6
History	701	614	87.6
Foreign languages	411	359	87.3
Political science	386	305	79.0
Sociology	329	252	76.6
Music	275	208	75.6
Mathematics	906	602	66.4
Economics	578	381	65.9
Biological sciences	2,114	865	40.9
Psychology	1,436	534	37.2
Engineering	2,532	912	36.0
Agriculture	1,036	347	33.5
Physics	1,338	384	28.7
Chemistry	2,192	500	22.8

[1] Excludes medicine and dentistry.

Source: National Education Association, Research Report 1965—R4, April 1965.

[17] The view that requirements for additional teachers in higher education may be less than those foreseen by the Office of Education, because of factors such as those indicated above, is forcefully argued by Allan M. Cartter, vice president of the American Council on Education, in a paper prepared for a forthcoming issue of the "Educational Record."

Teacher shortages, already serious in some fields, are expected to become greater. In its April 1965 report, the National Education Association said that of 1,084 degree-granting colleges and universities covered by its survey, about half (517) had teaching vacancies they could not fill during the last 2 academic years. The greatest shortages were in mathematics, reported by 166 institutions, and in physics, reported by 110 institutions. However, 8 out of 10 of the 1,084 institutions surveyed feared that teacher shortages would become even more acute. Again, mathematics and the broad area of the physical and natural sciences are the areas of most intense concern.[18] These shortages of teaching faculty affecting the entire higher education system, bear especially heavily upon smaller colleges and universities. In the face of rising student demand, their capacity to raise or even maintain teaching standards is imperiled, since stronger, more affluent institutions can dominate the market for scarce teaching talent.

[18] National Education Association, Research Report 1965—R4, "Teacher Supply and Demand in Universities, Colleges, and Junior Colleges, 1963–64 and 1964–65," April 1965.

III. FEDERAL RESEARCH AND DEVELOPMENT PROGRAMS HAVE UNQUESTIONABLY IMPROVED SCIENTIFIC HIGHER EDUCATION IN SOME PARTICULARS

The benefits for scientific higher education of the Federal research and development programs have been far-reaching. The major gains have come from the financial support given graduate science education, the encouragement given to improvement of science textbooks and curricula, and the rapid extension of education in the sciences into wider and more significant areas.

Graduate education in the sciences has been a principal beneficiary of the research and development activities of the Federal Government. Thousands of the best graduate students in the natural sciences are receiving financial support through fellowships and traineeships or through employment as assistants on university research projects. The best in laboratory equipment, supplies, and facilities, required for work on Government research projects, are also available for research use by graduate students.

Beyond these tangible benefits are the opportunities given to graduate students to participate in research projects. It is the conviction of educators that graduate education in the sciences can be conducted successfully only as a part of the research process. Mock research experiments are poor substitutes for the exploration of the unknown which is the essence of scientific activity. Only by participating in bona fide research projects are graduate students introduced to the real uncertainties and challenges—as well as the rewards—of science.

Undergraduates at exceptional institutions have to some extent shared these benefits. At the Massachusetts Institute of Technology, the enrichment of graduate departments, and research opportunities provided seenior faculty members, have helped the best of the science undergraduates. Dr. Sizer of MIT states:

> You would be pleased to know how many undergraduates now participate in research projects as part of their educational experience. The emphasis on research in certain of our institutions has resulted in the attraction of very large numbers of applicants for undergraduate study. By contrast, those institutions which do little or no research have not had as great an increase in number of applicants.[19]

Educators stress, moreover, that the research programs have lifted the level of graduate training in the sciences because professors, engaged in research work of significant value, are more stimulating as teachers and advisers to graduate students. A cross-fertilization ex-

[19] Irwin W. Sizer, head, department of biology, Massachusetts Institute of Technology, "Responses From the Academic and Other Interested Communities to an Inquiry by the Research and Technical Programs Subcommittee of the Committee on Government Operations," "Conflicts Between the Federal Research Programs and the Nation's Goals for Higher Education" (pt. 2), U.S. House of Representatives, 89th Cong., 1st sess., September 1965, p. 421. (Hereinafter referred to as Responses (pt. 2).)

ists between laboratory and classroom. The scientist engaged in research is a more effective teacher, for he brings to the classroom the excitement and stimulation which he finds in the laboratory. Moreover, the scientist who as a teacher is in contact with probing young minds is more likely to be a perceptive scientist. Thus, through the interaction of teaching and research, each gains from the other.[20]

The atmosphere of dedication and creativity has been extended beyond the confines of the Nation's greatest research-performing universities. Other graduate institutions have been enabled to carry on first-rate research as a result of the support provided by the Federal research programs. Thus, new standards of research excellence and graduate training in the sciences have been extended to additional graduate institutions.[21]

Moreover, textbooks and curricula have been greatly improved as a result of the program. Senior research scientists, interested in the quality of performance on research projects, have sponsored the improvement of textbooks and science curricula at all levels of education. In the dramatic case of mathematics, "new math" has penetrated down to the primary and kindergarten grades in many localities throughout the country. Substantial progress has also been achieved on textbook and curricula revision in high school courses in physics, mathematics, chemistry, and biology.

A Nobel laureate and professor of physics at Columbia told the subcommittee:

> In the last years professional scientists with distinguished records in research have been increasingly concerned with curricula in science, both for the prospective science major and the general student. The concern extends to teaching from literally the kindergarten to the graduate school. Numbers of texts are now available, any one of which is probably superior to anything available in the prewar era. * * * I am wholly of the view that the imagination and vitality to produce the text was a direct consequence of the intense involvement of the participants in research.[22]

Perhaps the most significant contribution by Federal research funds to science education is the heightened vitality of all scientific activity. Though difficult to document, this was well described by Dr. W. T. Lippincott, professor of chemistry, Ohio State University, in testimony before the subcommittee:

> Federal support has created opportunities for the evolution and advancement of human knowledge and for the stimulation of creativity far beyond the most prodigious expectations of our current senior scholars. University scientists, particularly the young men, with and without tenure, are

[20] See comments of Philip Handler, chairman, department of biochemistry, Duke University Medical Center, Responses (pt. 2), p. 236.

[21] Clinton D. Cook, dean of faculties, University of Vermont, "Responses From the Academic and Other Interested Communities to an Inquiry by the Research and Technical Programs Subcommittee of the Committee on Government Operations," "Conflicts Between the Federal Research Programs and the Nation's Goals for Higher Education" (pt. 1), U.S. House of Representatives, 89th Cong., 1st sess., June 1965, p. 32. (Hereinafter referred to as Responses (pt. 1).)

[22] Polykarp Kusch, fellow and professor of physics, Columbia University, Responses (pt. 2), p. 294.

> working unbelievably long hours and with a passion that suggests a compulsion to prove their worth to society.[23]

Better research facilities, and the opportunity to do sophisticated research, have greatly accelerated scientific activity and rapidly expanded scientific frontiers. In this fertile ground not only research but educational activities as well flourish. Better teachers are available to teach the fresh subject matter to be found in the expanded curricula in which they are vitally interested. Dr. Fred Harvey Harrington, president of the University of Wisconsin, made this observation in his response to the subcommittee inquiry:

> Undergraduate education is being improved continually; the impetus for the improvements and the direction in which they are being made are determined by results of recent research. Consequently undergraduate teaching is now better than it was immediately after World War II.[24]

Nevertheless, despite the glowing successes to date of the alliance of Federal money and university research, and in many cases on account of such successes, important conflicts and imbalances have arisen as a result of research programs to which the subcommittee has given its attention.

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[23] W. T. Lippincott, professor of chemistry at Ohio State University. See hearings before a subcommittee of the Committee on Government Operations, U.S. House of Representatives, 89th Cong., 1st sess., "Conflicts Between the Federal Research Programs and the Nation's Goals for Higher Education," June 14, 15, and 17, 1965, p. 5. (Hereinafter referred to as subcommittee hearings.)

[24] Responses (pt. 2), p. 249.

IV. FEDERAL RESEARCH AND DEVELOPMENT PROGRAMS HAVE HARMED SCIENTIFIC HIGHER EDUCATION BY EXCESSIVELY DIVERTING SCIENTIFIC MANPOWER FROM TEACHING, AND BY OVEREMPHASIZING RESEARCH TO THE DETRIMENT OF TEACHING

A. Scientific Manpower Is Drawn Into Noneducational Employment Rather Than Teaching

Federal research and development programs have increasingly drawn off professional manpower also needed for college and university teaching.

Any demand on the economy, public or private, of the size of Federal spending for research and development is also a demand for manpower on a large scale. The present $16 billion level of expenditures is huge by any standard. Constituting more than 15 percent of the entire Federal budget, Federal spending for research and development is equal to about 60 percent of the Nation's total annual investment in new housing and to about 70 percent of our total annual investment for new plant and equipment in all manufacturing. Federal research and development expenditures dwarf that of all other participants—in 1963, the National Science Foundation estimates that the Federal share was two-thirds of all spending for these purposes.

Manpower needs for the Federal research programs have been exceptional because of the huge annual increases in amounts spent. The expenditures' growth rate approached 20 percent per year in the period 1950–65. It far outran the annual growth rate of less than 5 percent in the Nation's supply of professional and technical personnel. Moreover, unlike Federal spending in similar scale for other purposes, research and development require a disproportionate number of persons of the highest levels of education and professional training, particularly scientists and engineers.

How many professional people have the Federal programs actually taken from the manpower pool which also supplies college and university teachers? How many of these people have formal training at levels which would qualify them for college or university teaching?

These questions cannot be answered with confidence, because the necessary manpower figures are not available. Despite the high priority of the Federal research and development programs and the rapidity with which they have been expanded, Federal agencies have not made systematic, continuing estimates of basic employment data needed to answer these questions with any degree of accuracy. Only rough guesses can be made on the basis of fragmentary and very much out-of-date figures.

In 1960, the national total of all types of scientists and engineers (including most social scientists) was estimated by the National

Science Foundation to be 1,275,000, of whom about a third, or 425,000, were working on research and development, and the remaining two-thirds in a variety of work including production, operations, administration, management, and teaching. Of the 425,000, 295,000 were employed by private industry, 55,000 by government (all levels), 55,000 by colleges and universities, and 20,000 by all others. While the NSF has estimated that the national total of scientists and engineers increased to 1,435,000 in 1963, it has not subjected this figure to an analysis similar to that for 1960.[25]

For a number of reasons, the 1960 analysis must be used with extreme caution even for making rough guesses on the extent and distribution of trained scientific manpower needed by the Federal research and development programs today. The manpower figures relate to all research and development, while the Federal demand is only for a portion, though a substantial one, of the total. In terms of funds provided, the Government accounts for about two-thirds of the total. Since 1960, Federal expenditures for these purposes have more than doubled—from $7.2 billion to over $16 billion today. Finally, the national total of scientists and engineers in 1965 is obviously greater than the estimated 1,275,000 of 1960 or even the 1,435,000 of 1963.

However, since manpower requirements by major categories of employers doing Federal research and development work can hardly be less than those of 1960, we can use these data to make minimum estimates of Federal demands today on the pool of scientific manpower from which colleges and universities seek teachers. If it is assumed that two-thirds of the 425,000 scientists and engineers working on research and development were employed on Federal rather than non-Federal programs, roughly 285,000 scientists and engineers were needed in 1960 for Federal programs. Of this group, some 248,000 were employed by private industry, government, and other noneducational groups. However, they could not all be considered qualified for college or university teaching. If those holding less than a master's degree were ruled out as having insufficient formal training, about half of the group, or 124,000 scientists and engineers, might be considered qualified for college teaching but working on Federal programs outside educational institutions.[26] This total is a rough measure of Federal competition in 1960 with colleges and universities for a limited manpower pool. The doubling of Federal expenditures on research and development since 1960 must also mean that Federal encroachment on scarce manpower resources is far greater today.

Even the figure of 124,000 is a significant one when it is measured against the full-time equivalent of 324,000 teachers now engaged in the entire system of higher education, or compared to the 210,000 nonadministrative, professional employees of the Federal Government (including those working on research and development).[27]

In agreeing that the Federal research and development programs have resulted in a major diversion of qualified scientists away from

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[25] National Science Foundation, NSF 63–23, "Profiles of Manpower in Science and Technology," 1963.

[26] Estimated on the basis of educational qualifications analyzed by the National Science Foundation of scientists and engineers included in the National Register of Scientific and Technical Personnel. (The NSF study for 1962 shows that about half of the scientists and engineers not at colleges and universities had master's degrees or better. See "American Science Manpower," 1962.

[27] Figure on teachers from unpublished estimates of Office of Education (see table II, p. 19) and on Federal employees from U.S. Civil Service Commission.

the Nation's higher education system, Dr. Philip Handler, member of the President's Science Advisory Committee and Vice Chairman of the National Science Foundation's National Science Board as well as chairman of the biochemistry department of Duke University, told the subcommittee:

> * * * Our national programs in space, in defense, and in medical research which are conducted both in Federal in-house and in contract out-of-house laboratories is the largest single consumer of scientific talent in our time. The very nature of much of such activity is foreign to the university campus whereas its performance requires the same kind of trained scientific talent as that which qualifies one for membership on a university faculty. Clearly our Nation must face this dilemma squarely and strike a balance among these programs which is commensurate with our diverse national goals. Were we to abandon the space program, there would become available for employment on college faculties a great number of physicists, chemists, biologists, engineers, astronomers, etc. If we are to continue the space program then we must learn how to operate our educational enterprise without the service of this same group. This is equally true for our defense effort and for much of the effort which relates to our attempts to conquer the dread diseases.
>
> The sum of such considerations is simply to indicate that there simply does not exist a supply of qualified scientists in numbers sufficient to mount all of our national enterprises at the levels, both quantitative and qualitative, which, as a nation, we appear to desire. Some compromise is imperative and it should be made after appropriate consideration and with due deliberation rather than as a consequence of the urging of any one special interest group.[28]

B. University Science Teachers Are Diverted to Research and Away From Teaching Within the Higher Education System

Federal competition for scientific manpower has not stopped at the gates of colleges and universities. Of the $16 billion in Federal Government obligations for research and development in fiscal 1965, about $1.1 billion was farmed out directly to colleges and universities, and an additional $700 million to research centers and laboratories operated by them. With these funds, constituting about 70 percent of all research funds received each year by educational institutions, and perhaps 15 percent of the Nation's total annual expenditures on higher education, the Federal Government reaches within the higher education system to claim a substantial share of the working time of college and university faculties, and a very high share of the time of science faculties.

Even in the face of rising and unfulfilled requirements for teachers, colleges and universities have responded to Federal demands for research by channeling an increasing number of professional employees into research work, by reducing teaching time of research-performing

[28] Responses (pt. 2), p. 240.

faculty, and by offering such reductions as inducements to attract new faculty.

In 1960, Dr. Warren Weaver, vice president of the Sloan Foundation, warned that Federal research funds were making it possible for scientists progressively to reduce teaching time, particularly in the teaching of undergraduates.[29]

In 1962, Dr. Harold Orlans of the Brookings Institution found that "emphasis on research has served to reduce teaching hours and to strengthen long-established tendencies to devalue undergraduate teaching at the great universities."[30] The National Academy of Sciences concluded in a 1963–64 study that university administrations were finding it profitable to offer scientists promises of reduction in teaching loads to do more research and, in the process, to make teaching a "poor relation" to research in the university.[31]

Members of the academic community told the subcommittee in response to its questionnaire that the offer of light "teaching burdens" was becoming a commonplace in the university competition for teachers in certain disciplines.

> It is paradoxical that, because of the shortage of qualified people, universities are bidding for those available in terms of salary, research facilities, and reductions in teaching load.[32]

Testifying before the subcommittee, Dr. W. T. Lippincott, professor of chemistry at Ohio State University, said that Government support of university research is "potentially the most powerful destructive force the higher education system in America has ever faced" because unprecedented opportunities for research are causing scientists to neglect the teaching of undergraduate students. He went on to say that the loss to students of "stimulation, guidance, and experience-inspired knowledge," which has traditionally been passed on to young people by research scholars, will affect the future supply of "dedicated teachers, competent scientists, engineers, scholars, and well-informed citizens."[33]

Only strong, well-financed institutions have been able to stem the tide and to maintain an equilibrium between research and teaching. Such institutions have been able not only to insist that their senior professors continue to do undergraduate teaching, but to hire enough additional faculty to offset any diversion of time to research. For example, Dr. John P. Trinkaus, director of graduate studies in the Department of Biology at Yale University, wrote the subcommittee:

> Yale undergraduates taking courses in biology have more contact with faculty now than at any time since I joined the Yale faculty in 1948. This is in part due to a deliberate effort on the part of the department and the university to make increased efforts to reach undergraduates, in part to an increased faculty-student ratio, and perhaps in part to the

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[29] Reprint: "A Great Age for Science," Alfred P. Sloan Foundation, New York, 1960, p. 23.

[30] Harold Orlans, "The Impact of Federal Funds on Higher Education," Brookings Research Report No. 5, Brookings Institution, October 1962, p. 3.

[31] "Federal Support of Basic Research in Institutions of Higher Learning," National Academy of Sciences, 1964, p. 93.

[32] Lloyd G. Humphreys, head, department of psychology, University of Illinois, Responses (pt. 2), p. 262.

[33] Subcommittee hearings, pp. 5–6.

fact that Government funds provide the faculty with increased assistance in their research. It is safe to say that by and large the best teachers of our department are spending more time teaching undergraduates than some of their less talented colleagues.[34]

The available figures show clearly that research has made serious inroads into faculty time within the higher education system as a whole, and especially in the sciences at the principal research-performing universities.

TABLE II.—*Growth in higher education enrollment, teaching staff, research staff, 1954–65*

[Thousands of persons]

Fall of year	Enrollment	Full-time equivalents of—			
		Teaching staff			Research staff
		Total	Senior staff [1]	Junior staff	
1953	2,236	177	169	8	23
1954	2,452	189	180	9	25
1955	2,660	196	186	10	27
1956	2,927	216	205	11	30
1957	3,047	227	216	11	33
1958	3,236	234	222	12	35
1959	3,377	242	230	12	37
1960	3,583	251	238	13	43
1961	3,861	264	249	15	50
1962	4,175	282	266	16	57
1963	4,495	297	280	17	65
1964	4,775	324	305	19	71

[1] Includes all instructional staff of instructor or above in resident degree courses; professional staff for extension, resident nondegree credit courses, and instruction by mail, radio, or TV, short courses, and individual lessons.

Source: Figures provided by the U.S. Department of Health, Education, and Welfare, Office of Education, July 1965.

Table II shows that, in the 12-year period 1953 to 1964, inclusive, the number of teachers (on a full-time equivalent basis) increased from 177,000 to 324,000, or only 83 percent, while enrollment more than doubled. As a result, the burden on teachers in the higher education system increased, with each teacher averaging about 14 students in 1964 compared to 12.5 in 1953. At the same time, the number of researchers working at colleges and universities more than trebled, from the full-time equivalent of 23,000 persons to 71,000 in 1964.

The table also shows that, in the higher education system as a whole, the present division of staff time is about 80 percent for teaching and 20 percent for research. These figures are, however, heavily weighted by faculties at smaller institutions and faculties in disciplines throughout the system, such as those in the humanities or the arts, where research is of little or no significance. They tell us nothing about the division of time between teaching and research in the disciplines in which research has been encouraged through the availability of Federal funds.

[34] Responses (pt. 2), p. 472.

The National Science Foundation undertook a study of the latter for the year 1961.[35] The NSF found that in 1961 the total number of scientists and engineers employed by colleges and universities was 175,600. However, they were concentrated at 400 institutions out of an estimated total of 2,000 in the country. Among the 175,600 scientists and engineers spread out among 400 colleges and universities, the division of time between teaching and research was 62 and 38 percent, respectively.

The study concluded, however, that about a fifth of this group of scientists and engineers were employed at nongraduate institutions with virtually no research activity. For the four-fifths at graduate institutions, where almost all the Nation's research is performed, the division between teaching and research was 53 and 47 percent, respectively. If a still smaller group is considered—the scientists and engineers at Ph. D.-granting universities—less time was devoted to teaching than to research, 48 and 52 percent, respectively. Furthermore, at graduate institutions the faculties of some science departments did a great deal more research than these averages indicate. For example, the division of time for research rather than teaching was 59 percent in physics, 68 percent in aeronautical engineering, and 86 percent in biochemistry. On the other hand, the division of time for research rather than teaching was relatively low in the social sciences (22 percent), mathematics (28 percent), and biology (32 percent).

The emphasis on research rather than teaching which shows up in these figures covering existing science faculty at graduate institutions appears moderate by comparison to the occupational preferences of new science Ph. D.'s. Table III below, based on a recent study by the National Academy of Sciences, shows the primary occupations, in the first postdoctoral year, of all persons earning doctorates in 1962. While 49 to 82 percent of the new Ph. D.'s in nonnatural science fields went into teaching as a primary occupation, only 23 to 25 percent did so in psychology and the natural sciences, where Federal and other funds heavily support research. Of the second group, two-thirds or more of the new Ph. D.'s in the physical and biological sciences chose to do paid research or received fellowships which enable them to do research.

These figures suggest that, as new Ph. D's are added to university science faculties and older members retire, the balance in favor of research and against teaching will increase.

Dr. Donald J. Zinn, chairman of the department of zoology at the University of Rhode Island, described the diversion of postdoctorates away from teaching in this way:

> The tendency among the newly created Ph. D.'s leaving this campus and in those invited to come to it as instructors is to first attempt a postdoctoral career at Uncle Sam's expense and then at the end of this time maintain a grant with ONR, NASA, NIH, NSF, etc., to carry into their new positions. In some aspects this is certainly praiseworthy, but contrariwise it is a situation in which considerations germane to this question throttle the amount of teaching to which these instructors may be assigned.[36]

[35] National Science Foundation, NSF 63-4, "Science and Engineering Professional Manpower Resources in Colleges and Universities," 1961.
[36] Responses (pt. 1), pp. 76–77.

TABLE III.—*Primary postdoctorate occupations of 1962 Ph. D.'s, year following receipt of degree*

[Percent distribution]

Field	Research and fellowships			Teaching	All other
	Total	Research	Fellowships		
Physical sciences	66.9	49.4	17.5	25.3	7.8
Biological sciences	69.1	41.8	27.3	23.5	7.4
Psychology	38.8	26.0	12.8	23.3	37.9
Social sciences	21.3	17.7	3.6	66.1	12.6
Arts and professions	6.5	4.3	2.2	82.4	11.1
Education	5.7	4.8	.9	49.2	45.1
All fields	40.6	28.5	12.1	42.2	17.2

Source: National Academy of Sciences-National Research Council, "Background and Experience Patterns of the Doctorates of 1962," Scientific Manpower Report No. 5, by Lindsey R. Harmon, Jan. 18, 1965.

C. EVEN APART FROM SUCH DIVERSION, UNDERGRADUATE SCIENCE TEACHING TENDS TO BE DOWNGRADED

In addition to claiming a large share of faculty time for research, Federal programs have had other unmeasurable but no less damaging effects on higher education. Federal science research money has strongly reinforced a trend which Dr. Jacques Barzun, provost of Columbia University, terms "the new frenzy for research." [37] In the process, the value of teaching at universities has been depreciated; teachers forced into a research "publish-or-perish" pattern; abler graduate students lured into research; and young Ph. D.'s deflected from early entry into college teaching. Undergraduate teaching is all too frequently a thankless chore left to those unable to get research money—whether senior professors or younger assistants. In this topsy-turvy situation, the undergraduate may find that the university established mainly for his sake has no real place for him in the new scheme of things.

Research is not always pursued for impeccable, scholarly motives. It can be exploited as an avenue to recognition, prestige, and—not least—money. It has the advantage of being highly visible and thus useful in the competition for professional esteem and position. Teaching offers no such advantage, and its less tangible rewards lack appeal to many ambitious members of faculties.

Dr. Alan M. Thorndike, senior physicist at Brookhaven National Laboratory, told the subcommittee:

> In the scientific community research is an activity of greater prestige than teaching. There is no Nobel Prize for teaching. Accomplishment in research is also rewarded in many less dramatic ways—publications, invitations to prestigious conferences, easier access to crucial information and to funds, committee memberships, and means to influence the development of one's field of interest. Accomplishment in teaching is not recognized as clearly. In fact, it is not easy even to identify outstanding teachers.[38]

The less scrupulous simplify matters for themselves by doing research not for the sake of research, but for the sake of piling up

[37] Responses (pt. 2), p. 145.
[38] Responses (pt. 2), p. 466.

research grants. Dr. Donald H. Riddle, dean of the faculty in the College of Political Science at Rutgers University, believes this perversion of research activity not uncommon:

> At almost any sizable university there are at least one or two faculty members who would be willing to research almost any problem that somebody will support financially.[39]

Gerald Piel, publisher of Scientific American, told the subcommittee that Federal research contracts have undermined the integrity of the Nation's major universities as centers of higher education "especially in the sciences and including even graduate education," because intellectuals, in their avidity for research money, have become mercenaries of science and scholarship.[40] One teacher expressed his concern as follows:

> It is no longer unusual for a friend or colleague to tell me, with obvious great satisfaction, that hereafter he will receive a substantially higher salary and that he will have only two graduate seminars to teach or only a graduate seminar and research.
>
> * * * * *
>
> * * * A force has been let loose by the Federal programs which has altered many relationships and values, quite beyond those that might have been anticipated.[41]

A departmental chairman described the "leverage" which research funds give scientists to dictate their own terms on the amount of teaching they will do:

> * * * consider a distinguished scientist in a particular field who may command research support for his program of several hundred thousands of dollars per year. As an individual, he may command more support than the rest of his department, taken altogether—more than the chairman of his department and, in some cases, even more than the dean of his college. He is in a position to exercise immense leverage because of the funds at his disposal. In many cases he provides funds for most of his own salary. All of his equipment comes from Federal funds, as does the support for six or seven graduate students in the department. He gets his own way and teaches very little. If complaints are made about his activities, he threatens to "pick up his marbles" and go elsewhere.[42]

Teachers are forced to do research and to publish in order to move up the academic ladder. "Publish or perish," the rule of the research world, has been inappropriately taken over and applied to faculty whose main talents and interests lie in teaching. Thus, students may be denied good teaching while teachers are forced to undertake research and to publish against their will.

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[39] Responses (pt. 2), p. 388.
[40] Responses (pt. 2), p. 370.
[41] Milton R. Konvitz, professor of law and of industrial and labor relations, Cornell University, Responses (pt. 2), p. 292.
[42] Howard A. Schneiderman, chairman, department of biology, Western Reserve University, Responses (pt. 2), pp. 412–413.

Among the most perceptive comments received by the subcommittee on this problem were those which came from students.

One wrote:

> * * * The "publish or perish" rat race is coming under a lot of fire in modern universities, yet no one seems to want to do anything about it. I have found that many of the best research scholars do not make good teachers and, conversely, that many excellent teachers, while doing research on their own, do not like to publish. Yet, due to the emphasis on publishing in the university world, the teachers who get promoted are those who publish—whether their works are good or bad, whether their teaching is good or bad. I think this is, to a large extent, due to the fact that universities can obtain grants through individuals who have obtained a reputation in their field—through publishing. Thus, they encourage it by basing promotions on it, and the whole teaching profession suffers.[43]

Another pointed out that the pressure to publish will drive young teachers seeking tenure to sacrifice teaching in order to go into research. He added:

> * * * While this problem may not be directly related to Government grants for research, it seems to me that the current emphasis on research in all fields may be related to Government and private encouragement of research in science and near sciences (e.g., economics).[44]

A third summed up the situation pungently by saying that undergraduate education is suffering, not because talented professors and superior graduates find research more rewarding than teaching; they find research more mandatory than teaching.[45]

The abler graduate students and young postdoctorates go into research—the less able, teach. Federal research policies, university policies, and the shifts they have caused in academic regard for research and teaching combine to deflect abler graduate students and those with newly earned doctorates away from teaching and into research. Since large universities have traditionally drawn on this group to supplement their teaching force, loss of the most able to research means reliance on the less competent for teaching.[46]

Federal policies with respect to graduate fellowships and research assistantships are in part to blame. Fellowships do not require holders to teach. Research assistantships pay generously for the research services of students employed on projects. Only those who lack fellowships or research assistantships, therefore, are candidates for teaching assistantships. The adverse effects of these policies on undergraduate instruction and even on the quality of some new Ph. D.'s were pointed out by Dr. W. Albert Noyes, Jr., professor of chemistry at the University of Texas:

> The availability of unrestricted fellowships and of research grants which permit graduate students to be paid as research

[43] R. Crist Berry, student, Brown University, Responses (pt. 2), pp. 151–152.
[44] Michael A. Avery, student, Yale College, Responses (pt. 2), p. 136.
[45] Johnnie Adams, student, Michigan State University, Responses (pt. 2), p. 121.
[46] See William J. Baumol, professor of economics, Princeton University, Responses (pt. 2), p. 147.

rather than as teaching assistants has had the effect of making teaching assistantships hard to fill and of filling them with the poorer graduate students. To this extent undergraduate instruction has been adversely affected in many large institutions. * * * The net effect of abundant Federal money for fellowships and research assistantships may actually have lowered the standard for the Ph. D. degree by causing the employment of substandard graduate students to teach.[47]

A student who wrote the subcommittee agreed, in stronger language:

> It is my opinion that today more teaching is left to graduate students who may not be qualified. For instance, I have an instructor [who] * * * is often unprepared to teach the class. * * * It might be said that the reason for such people being in the teaching position is the shortage of teachers. To the extent that this shortage is worsened by research, I feel that education is suffering from an overemphasis on research.[48]

Federal policies on postdoctoral fellowships strongly reinforce the movement away from teaching. Dr. Arthur W. Martin, professor of zoology, University of Washington (Seattle), feels that an excessive amount of money is made available for postdoctoral students.[49] These persons, though not on faculty rosters, can remain at universities without teaching for years. If they do turn to the classrooms,[50] they can enter teaching at higher salaries, because of their research and publications, than their colleagues who have been teaching during the period. Hence postdoctoral fellowships not only divert valuable personnel from the classroom, but discourage others who do wish to teach. For research during this period brings both higher short-term and long-term rewards.

Universities with ample funds could avoid reliance on unqualified graduate students for teaching by offering salary and other inducements to qualified doctorate holders to become members of their regular faculty. But not all choose to do so. For adding new faculty just for the sake of improving undergraduate teaching might dilute the research reputations of established departments. Dr. Walter P. Metzger, professor of history at Columbia University, explains:

> The growth of surrogate instruction stems not only from the reductions in the teaching load of the established faculty, but from the reluctance of the established faculty to add new members to bear that load. Research-centered institutions have high aspirations and august self-images. They cannot and will not make wholesale permanent appointments to match the rapid growth of student bodies. Rather than attenuate the quality of their staff, they would rather attenuate the quality of their instruction. The fact that this strategy is economical makes it even more attractive * * *.[51]

[47] Responses (pt. 2), p. 339.
[48] Responses (pt. 2), pp. 134–135.
[49] Responses (pt. 2), p. 319.
[50] Dr. W. T. Lippincott, professor of chemistry at Ohio State University, makes the point that many do not, subcommittee hearings, p. 5.
[51] Responses (pt. 1), p. 56.

The undergraduate is the victim. Huge enrollments are, of course, basically responsible for dilution in the quality of undergraduate instruction. But the stampede into research has aggravated the problem at many places. As Dr. Clark Kerr, president of the University of California, has stated:

> There seems to be a "point of no return" after which research, consulting, graduate instruction become so absorbing that faculty efforts can no longer be concentrated on undergraduate instruction as they once were. This process has been going on for a long time; Federal research funds have intensified it. As a consequence, undergraduate education in the large university is more likely to be acceptable than outstanding; educational policy from the undergraduate point of view is largely neglected. How to escape the cruel paradox that a superior faculty results in an inferior concern for undergraduate teaching is one of our more pressing problems.[52]

The New York Times in an editorial of April 30, 1965, said more bluntly:

> The innocent freshman arriving on campus with the idea that a university is a place to have intimate contact with great and learned minds often discovers that some of the faculty want to have as little as possible to do with the students.

John Fischer, editor of Harper's, asked in an impassioned article in the magazine's February 1965 issue, "Is There a Teacher on the Faculty?" Students are returning to their campuses, he said, with "the swelling suspicion that they are getting gypped," and that the universities are "capable of providing far better education than they are putting out but that the faculty members 'scrimp on teaching' and 'begrudge every minute stolen from the lab'." [53]

As a consequence, there have been outbursts of student discontent.

Beginning in December 1964, the huge campus of the University of California at Berkeley was rocked by a student revolt, ostensibly centering on "free speech" issues. But as the Wall Street Journal pointed out, many university administrators and teachers felt that the issues were merely an outlet for a strong undercurrent of dissatisfaction with growing undergraduate neglect, in turn caused by the massive increase in Federal research money.[54]

In March 1965, Yale University students began picketing the administration buildings because academic tenure was denied a popular young professor on the ground that he had failed to write and publish enough books. When the university administration stood by its decision, the students engaged in a "mourning vigil" in front of President Brewster's offices.[55]

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[52] Dr. Clark Kerr, The Uses of the University, Harvard University Press, 1963, p. 65. See excerpts in Responses (pt. 2), p. 280.

[53] See excerpts in Responses (pt. 2), p. 216.

[54] May 4, 1965.

[55] The New York Times, Mar. 11, 1965.

D. Recommendations

The subcommittee finds that too many scientists and engineers have been diverted over a relatively short period into research work, and too few are available for teaching. It will be necessary both to limit the requirements for research manpower over the short term and, through an appropriate system of incentives, to increase the flow of qualified personnel into teaching. In order to balance the present use of scientific manpower on research problems with investment in the education of new manpower for the future, the following policy changes and actions are needed:

1. **Maintain scientific manpower data.** The Bureau of the Budget acting in coordination with the Office of Science and Technology, the National Science Foundation, and the Departments of Labor and of Health, Education, and Welfare, should gather reliable up-to-date data on the national pool of scientists, engineers, and other professional personnel employed under Federal research programs—by professional category, by category of employer, by Government agency sponsoring the program, and by field of research—and to publish these data at least yearly. Where the material has a security classification, it should be handled in accordance with usual security procedures.

2. **Weigh priorities between teaching and research.** On the basis of such information, the Bureau of the Budget should scrutinize all Federal research and development programs with a view to balancing the manpower needs for research and development, on the one hand, and the needs for teachers at colleges and universities, on the other. Major programs making substantial demands on scientific manpower should not be undertaken, continued, or expanded, if the need for such programs is considered to be of lower priority than the need to assure an added supply of teachers for the higher education system. Such a scrutiny could also uncover duplicating research projects. The annual budget should include a comparison of past and proposed scientific manpower needs in accordance with changes in proposed spending for research and development.

3. **Encourage researchers to teach.** Research grants and contracts should be drawn in such a way that encouragement is given to senior investigators to teach as well as to perform research. Grants or contracts prohibiting teaching should be permitted only for clearly defined exceptional circumstances. In order to encourage the early entry into teaching of the ablest graduate and postdoctoral students, all holders of Federal fellowships, research assistantships, and traineeships should be required to devote a portion of their time during graduate or postgraduate training to undergraduate teaching wherever need for additional teachers exists.

4. **Institute science teaching fellowships.** The major Federal science agencies (DOD, NIH, AEC, NASA, NSF) should, by new legislation where necessary, institute programs of science teaching fellowships in mission-related science fields with awards at least as attractive as those available under the present fellowship and traineeship programs (principally NSF and NIH). Such science teaching fellowships need not result in a higher global total of funds devoted to Federal research programs.

5. **A Presidential award for outstanding undergraduate teachers.** To assist in the recognition of excellence in teaching, the President should consider instituting a program to reward and to recognize outstanding undergraduate teachers at colleges and universities each year. Recognition could take the form of a cash prize and a medal or citation presented by the President at a public ceremony, with teachers selected by expert panels drawn from the college and university community. The principal responsibility for maintaining balance between teaching and research is, and should remain, that of the educational system itself. Colleges and universities should themselves undertake, as a priority task, the restoration of the prestige and rewards that are due excellent teachers.

52-569—65——5

V. THOSE FEDERAL RESEARCH AND DEVELOPMENT PROGRAMS DIRECTED AT SCIENTIFIC RESEARCH IN UNIVERSITIES AND COLLEGES HAVE HARMED HIGHER EDUCATION BY CONCENTRATING SUCH PROGRAMS IN A WAY THAT IS DETRIMENTAL TO SCIENCE EDUCATION IN SMALLER INSTITUTIONS

A. Federal Funds Have Been Concentrated in a Few Large Universities

Which are the recipients of Federal research and development funds among the educational institutions? Studies by congressional committees and private organizations show a high degree of concentration of these funds in a few major universities.[56]

These studies and the subcommittee's present inquiry have been handicapped by lack of uniform, up-to-date statistical information. Not only is there no single source for this information. The major Federal agencies having university support programs follow no consistent set of definitions in keeping records, so that figures of one agency cannot meaningfully be combined with those of another. Because of the absence of any continuing data on the distribution of science funds to universities, a private organization publishing the magazine Industrial Research has for 3 years sent out questionnaires and compiled its own figures to supply information to its readers.

It would be helpful for the Bureau of the Budget to collect and make available current data on the distribution of Federal research funds to individual educational institutions.

To determine the extent of concentration in funds presently distributed to universities and to identify the major recipients, the subcommittee asked the five principal Federal research agencies with programs at educational institutions to submit data on research funds and educational support funds disbursed to the 25 largest recipients in fiscal 1964. These data are shown in appendix table A and summarized in table IV.

Table IV shows a high degree of concentration for four of the five principal agencies with research programs at universities. From 58 to 76 percent of science funds spent at universities by the National Institutes of Health, the Department of Defense, the National Aeronautics and Space Administration, and the Atomic Energy Commission went to the top 25 recipients for the respective agencies. Even in the case of the National Science Foundation, specifically charged to

[56] Harold Orlans, "The Effects of Federal Programs on Higher Education," Washington D.C., the Brookings Institution, 1962; Report of the House Special Subcommittee on Education, U.S. House of Representatives, 88th Cong., 1st sess., "The Federal Government and Education." H. Doc. No. 159, June 14, 1963; Report of the Select Committee on Government Research, U.S. House of Representatives, 88th Cong., 2d sess., "Impact of Federal Research and Development Programs," study No. VI, Washington, Dec. 28, 1964; Report of the Committee on Science and Astronautics, U.S. House of Representatives, 89th Cong., 1st sess., "Geographic Distribution of Federal Research and Development Funds," Government and Science No. 4, Feb. 26, 1965; "1965 I–R Survey of University Research," Industrial Research, vol. 7, No. 4, April 1965, pp. 48–49.

assist in science education, the top 25 claimants received 40 percent of the funds. Since there are differences in the composition of the lists of the top 25 institutions for each agency, there are, in fact, 54 separate universities represented among the leading recipients of the five principal Federal agencies. These 54 universities, out of a total of over 2,000 colleges and universities in the country, receive about 60 percent of all funds going to educational institutions for research and science education.[57]

TABLE IV.—*Share of top 25 universities in total Federal funds for research and science education, fiscal year 1964*

Agency	Total, all educational institutions (thousands)	Top 25 universities	
		Amount (thousands)	Percent of total
National Institutes of Health	$577,594	$336,365	58.2
Department of Defense	400,977	306,218	76.4
National Science Foundation	338,932	135,507	40.0
National Aeronautics and Space Administration	88,779	57,325	64.6
Atomic Energy Commission	62,542	43,404	69.4
Total	1,468,824	878,819	59.8

Source: Appendix table A.

NOTE.—The top 25 universities are not the same for each agency. There are a total of 54 institutions included in the top group of the 5 agencies.

Through an analysis of fiscal 1963 data on research only, the National Science Foundation came to similar conclusions with respect to the extent of concentration of funds. It found that 100 colleges and universities accounted for more than 95 percent of all funds, 50 institutions received 75 percent, and 10 received about 35 percent.[58]

The concentration of funds is not just in terms of the number of institutions, but also in terms of the type of institution supported. All of the 54 top recipients of Federal science funds are Ph. D.-granting institutions or advanced institutes of technology. Few could be described as representing smaller universities, and none are 4-year colleges awarding just the baccalaureate degree.

This neglect of all sectors of higher education save the Ph. D.-granting institutions is confirmed by the National Science Foundation analysis mentioned above. The NSF found that in fiscal 1963, 96 percent of all funds went to Ph. D.-granting institutions. Only 1 percent of the money went to 4-year colleges despite the fact that from 137 of these colleges, 25 percent of all science baccalaureates receive their degrees. Another 137 colleges and universities, responsible for about 14 percent of all master's degrees in science and engineering, received only 3 percent of the 1963 funds.

In testimony before the subcommittee, Dr. Fay Ajzenberg-Selove, professor of physics at Haverford College and executive secretary of the Committee on Physics Faculties in Colleges, stated that 600-odd colleges awarding 55 percent of all bachelor's degrees in physics received only 12 physics grants in fiscal 1964. The 12 grants totaled less

[57] The total of $1,468,824,000 does not agree with the total given in "Federal Funds for Research, Development, and Other Scientific Activities" for two main reasons: National Science Foundation funds for science education are included in our figures and the Department of Defense data include funds for contract research centers operated by universities. Funds for similar centers operated on behalf of other agencies are excluded.

[58] Unpublished analysis by National Science Foundation.

than $300,000 or about 2 to 3 percent of all Federal research funds for physics available in that year.[59]

The pattern of concentration of research funds has meant a similar concentration of research opportunities and incentives for scientists and engineers. Favored universities have been able to attract and keep the best scientists and graduate students. Institutions not so favored have lost many of their ablest professors, and are unable to compete on equal terms for replacements. Thus, the Federal research programs have not only made already strong institutions stronger. They have done so partly at the expense of the weak.

Dr. Charles W. Burmeister, chairman of the physics department of Trinity University, cited a specific case in testimony before the subcommittee to illustrate why institutions outside the charmed circle of research fund recipients fail to retain scientists with established reputations. Dr. Burmeister said that a member of the physics faculty at his institution had, during his previous employment at Bell Telephone Laboratories, helped obtain a $300,000 Federal research grant. After joining the faculty at Trinity, he submitted two research proposals to the National Science Foundation. Both were rejected—not because his proposals lacked scientific merit, but rather because his teaching load was considered to be too great in comparison with the smaller load carried at the larger universities.[60]

Dr. Alan M. Thorndike, senior physicist at the Brookhaven National Laboratories, in a letter to the subcommittee, states that the prospect of all teaching and no research in a small college led him to abandon the offer of such a position:

> Several years ago I gave some thought to taking a position as chairman of the physics department (it had another member besides the chairman) at a typical New England liberal arts college. It had appealing features, but seemed like a step back into a previous century, and I decided to stay with the 20th * * *.

He concluded:

> * * * The great difference between a large university active in many research fields and a small college in which the vast majority of effort goes into classroom teaching is an element of unbalance to my mind. The country needs different kinds of institutions, but it does not seem desirable that standards in them should be so variable.[61]

A student at an excellent small college in the Midwest in a letter to the subcommittee said briefly but eloquently:

> * * * It is said that once a science teacher has spent 4 years here he is through as a researcher anywhere. This scares quite a few good men to the larger universities—it scares them away from teaching.[62]

[59] Subcommittee hearings, p. 15.
[60] Subcommittee hearings, p. 63.
[61] Responses (pt. 2), p. 467.
[62] Gary Beauchamp, student at Carleton College, Responses (pt. 2), p. 148.

B. Federal Funds Have Been Concentrated in a Few Geographic Areas

There is, in addition, a high degree of concentration of funds geographically. In recent years more than 60 percent of all Federal science funds for educational institutions have gone to institutions in five States—California, Massachusetts, New York, Illinois, and the Maryland-District of Columbia area.[63] Thus, these funds have done little to assist in the development or establishment elsewhere of centers of excellence, whether of science education or of research.

As Dr. Lloyd V. Berkner emphasized in his comments to the subcommittee, the establishment of such centers throughout the country is essential if the talents of many able young people are not to be lost to research and college teaching.[64] Bright college graduates as well as high school graduates tend to go on to higher studies in greater numbers when good colleges and universities are nearby. Both lack of money and strong local ties prevent many such students from going to distant places for higher studies.[65]

C. Such Concentration Does Not Appear To Have Yielded Compensatory Returns in the Training of Young Scientists and in the Improvement of Undergraduate Education Generally

In compensation for the draining of faculty into the major graduate institutions, are Federal science funds spent in the higher education system resulting in higher rates of additions to the pool of trained scientific manpower and in the improvement of undergraduate education generally? Such advances in the training of young scientists have been assumed to be the case by the Federal Government as well as by the scientific community.

For example, the Bureau of the Budget states in its summary of fiscal 1966 budget proposals for $5.5 billion in basic and applied research funds that higher proportions of these funds should be spent at universities since

> * * * universities have traditionally been the main source of new ideas in science through research carried out by faculty members assisted by graduate students. The interaction of research and education in academic institutions thus contributes both to the advancement of research *and to the training of scientific and technical manpower.* [Emphasis added.][66]

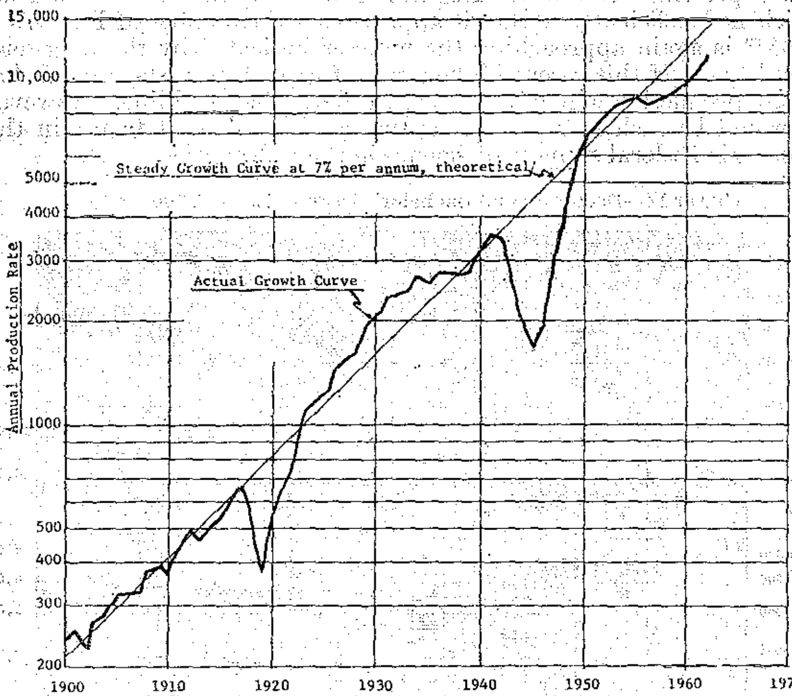
In its testimony before the subcommittee on June 17, 1965, the Office of Science and Technology associated "the improvement and spread of graduate education" with the availability of Federal research money to universities. It stated that

> * * * Ph. D. awards in the natural sciences have increased from about 3,800 in 1953–54 to about 6,600 in 1963–64. In the period 1945–49, the first 10 schools produced 46 percent of

[63] See Report of the Committee on Science and Astronautics, Government and Science, No. 4, "Geographic Distribution of Federal Research and Development Grants," 1965, 89th Cong., 1st sess., p. 7, fig. 2.
[64] Responses (pt. 1), p. 12.
[65] See also National Science Foundation, 14th Annual Report 1964, pp. 9–10.
[66] The Budget of the U.S. Government, fiscal year ending June 30, 1966, Special Analysis H, p. 446.

the Ph. D.'s in the natural sciences, and the first fifteen produced 60 percent. By 1961, the first 10 schools accounted for only 35 percent of the Ph. D.'s and the first 15, 46 percent. Thus we have many more students in more schools producing more science.[67]

CHART I—Doctorate Production in U.S. Universities, 1900 to 1962



Source: National Academy of Sciences-National Research Council, "Doctorate Production in U.S. Universities, 1920–62," Publication 1142, Washington, D.C., 1963, p. 3.

The subcommittee finds, however, that Federal programs are not adequately broadening the educational base of science, that Federal funds are not yielding proportionate returns in the training and education of young scientists, and that research funds are highly concentrated in a few major institutions to the detriment of others in the higher education system.

1. NO CLOSE RELATIONSHIP IS DISCERNIBLE BETWEEN THE VOLUME OF FEDERAL SCIENTIFIC RESEARCH FUNDS AND TOTAL SCIENCE DOCTORATES AWARDED

The available evidence fails to show any consistent relationship between the volume of Federal science funds going to the higher education system and the accelerated development of scientific manpower.

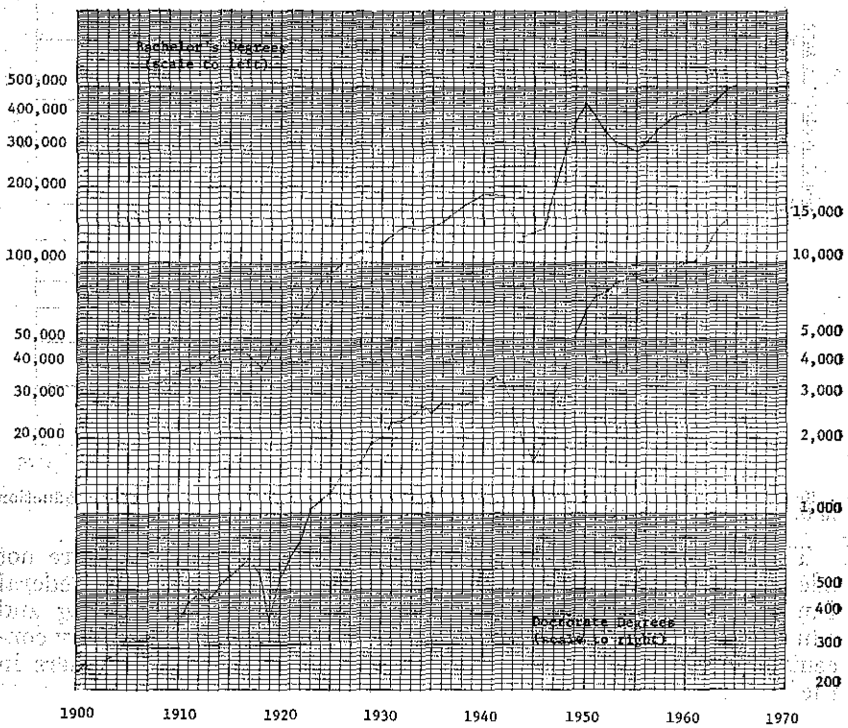
A National Academy of Sciences study on doctorate production from 1900 onward[68] concluded that there has been a long-time trend for

[67] Subcommittee hearings, p. 96.

[68] National Academy of Sciences-National Research Council, Doctorate Production in U.S. Universities, 1920–1962, Publication No. 1142, Washington, D.C., 1963.

doctorate holders to increase at an average rate of 7 percent per year. (See chart I.) Until the past decade, this trend was interrupted in a major way only during the two world wars, when Ph. D. output declined drastically, and in the period of the great depression, when Ph. D. output was substantially above the long-term trend line. But from the mid-1950's when Federal money was pumped into universities at a progressively increased rate, Ph. D. production fell seriously below the 7 percent trend line. Beginning in 1961, the rate of increase quickened sufficiently so that it appears that the number of Ph. D.'s in 1964 [69] is again approaching the number indicated by the long-term trend line. If this recent higher rate of growth persists, annual doctorate production will, of course, move above the trend line. However, it would be rash to assume that the dominant causal factor in this process is Federal support of science in the universities.

CHART II—Doctorate and Bachelor's Degrees Earned, 1900 to 1965



Source: Doctorate degree figures from National Academy of Sciences-National Research Council, Washington, D.C.; bachelor's degree figures (including first professional degrees) from U.S. Office of Education.

First of all, in the recent upsurge in the annual numbers of earned doctorates, generally unsupported nonscience fields showed much the same pattern of increase as that shown in the natural sciences where nearly all the Federal research money has gone. This strongly suggests that factors other than the flow of Federal funds to the sciences

[69] National Education Association estimate for academic year 1963–64, 14,490; National Academy of Sciences estimate for calendar year 1964 included in letter of Office of Science and Technology, 14,856.

are responsible for a generally higher participation in graduate studies leading to the doctorate, and that these factors have affected the sciences and nonsciences alike.

For example, changes in the size of the bachelor's degree population are of significance in this connection, since first degrees must usually be completed before students enter graduate studies and go on to the doctorate level. Chart II shows that major shifts in the numbers of bachelor's degrees earned have generally been followed after an interval by shifts in the same direction of Ph. D. production. Following World War II, a sharp rise in bachelor's degrees, fueled by the GI bill, peaked in 1950, and the peak in Ph. D. production occurred a few years later. A sharp drop in bachelor's degrees in the early fifties is followed by a pause and slight drop in the numbers of doctorates in the mid-1950's. The subsequent recovery in the numbers of bachelor's degrees awarded is now being followed by a rise in doctorate production.

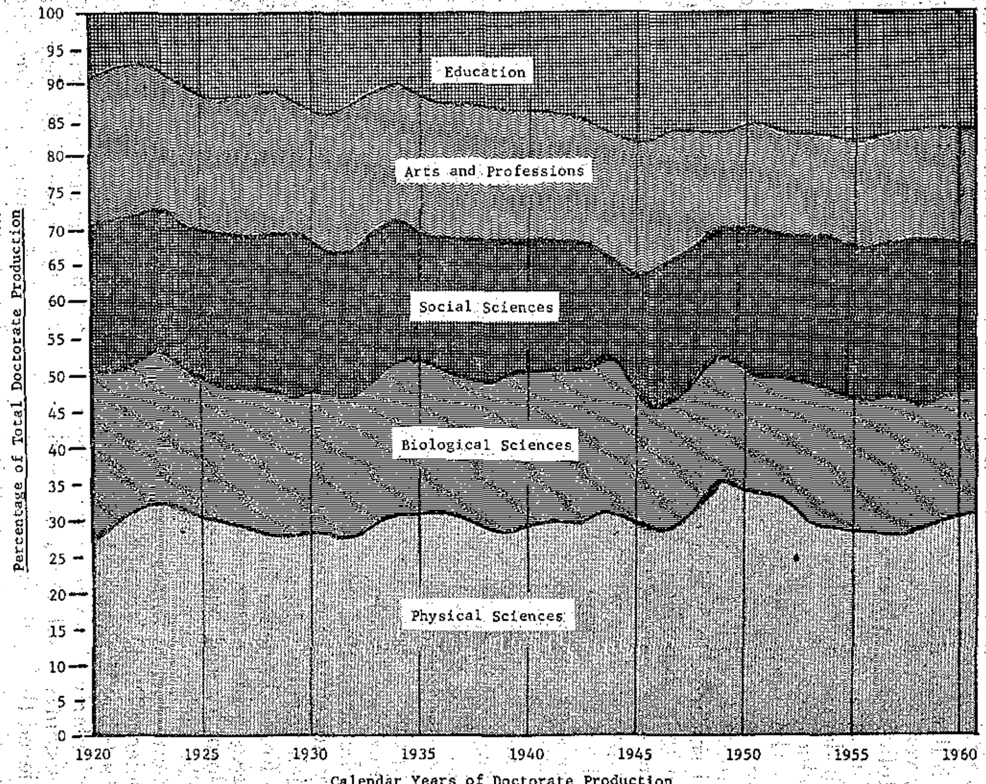
If the increasing flow of Federal science funds to the universities were a significant factor in adding to the annual output of doctorates, it would be logical to expect the proportion of doctorates in the natural sciences, in which support has been concentrated, to be higher than in past periods. This is not the case. As chart III indicates, the present share of the sciences in the total output of Ph. D.'s is less than proportions which have existed at times in the past. The share of the sciences was higher in the years following World War I, the depression period of the 1930's through to the last years of World War II, and again, in the late forties. Thus, heavy support of science appears to coincide with a relatively smaller share of doctorates in the sciences, while nonsupport did not prevent a relatively larger share.

Nor does Federal support of the sciences as a causal factor in doctorate production explain differences in Ph. D. growth among different disciplines. According to the National Academy of Sciences study, engineering doctorates increased 55 percent in the period 1955–61. If this be attributed to the existence of Federal science funds, why were they not equally potent in the case of chemistry and physics Ph. D.'s which rose only 13 and 19 percent, respectively, in this period? And are Federal science funds an appropriate or adequate explanation for increases in doctorates in the same period of 41 and 73 percent for philosophy and business administration, respectively?

The lack of a necessary causal relationship between the volume of Federal science funds made available to universities and the number of science Ph. D.'s can be seen in other ways.

As table V shows, the Nation's top producers of science Ph. D.'s, particularly those ranking among the first five or six, have not only consistently held the lead during the past 10 years but they had achieved their relative status a decade ago. It follows, therefore, that Federal science money may have helped these universities to retain their positions but not to attain them. California, MIT, Purdue, Wisconsin, Illinois, and Michigan were the great producers of science doctorates in 1955 as they were in 1964, even though in the earlier period the Federal research programs at the universities were in their infancy.

CHART III—Varying Proportions of Doctorate Production Over 42-Year Period



Source: National Academy of Sciences-National Research Council, "Doctorate Production in U.S. Universities, 1920–62," Publication 1142, Washington, D.C., 1963, p. 7.

TABLE V.—*Doctorates granted by 15 leading universities in selected fields of science* [1]

	1964		1963		1962		1961		1960		1959		1958		1957		1956		1955	
	Rank	Number	Rank	Number	Rank	Number	Rank	Number	Rank	Number	Rank	Number	Rank	Number	Rank	Number	Rank	Number	Rank	Number
University of California	1	359	1	333	1	330	1	260	1	227	2	178	1	190	1	195	1	167	1	212
Massachusetts Institute of Technology	2	255	2	237	3	198	3	178	3	165	1	182	3	142	2	153	2	147	2	163
Purdue University	3	180	4	176	6	132	5	119	5	115	7	95	4	127	5	106	5	121	6	107
University of Wisconsin	4	155	5	144	4	162	4	139	4	116	5	108	6	95	4	120	4	127	3	147
University of Illinois	5	151	3	185	2	211	2	187	2	184	3	139	2	144	3	122	3	131	4	147
University of Michigan	6	148	8	132	5	137	6	116	6	99	4	116	8	89	6	105	6	98	5	121
Stanford University	7	141	6	142	7	126	8	84	12	65	11	68	9	80	10	66	14	47	12	64
Harvard University (including Radcliffe)	8	130	7	135	10	91	9	81	7	98	6	98	7	91	9	71	12	55	8	87
Iowa State University	9	127	10	106	12	89	10	79	13	65	15	43	12	64	13	59	10	68	11	67
Columbia University	10	127	11	95	8	100	7	109	8	93	9	78	10	78	7	87	7	77	9	75
University of Texas	11	113	12	95	14	87	15	62	14	63	12	62	14	49	14	55	11	59	10	71
Ohio State University	12	102	9	113	11	91	11	68	9	78	8	81	5	97	8	74	9	69	7	90
Princeton University	13	91	14	82	13	88	13	67	15	52	14	54	15	45	15	43	15	46	14	54
New York University	14	89	15	82	15	73	12	68	11	70	13	59	11	73	12	63	13	49	15	53
Cornell University	15	83	13	83	9	94	14	66	10	76	10	75	13	57	11	65	8	72	13	64

[1] Includes engineering, mathematics, chemistry, physics, biology, botany, zoology, bacteriology, and biochemistry. The 15 were selected only on the basis of 1964 comparative data so that some errors of inclusion and exclusion for other years are possible.

Source: Prepared by Science Policy Research Division, Library of Congress, Legislative Reference Service, and U.S. Office of Education, July 1965.

TABLE VI.—*Top 15 producers of science doctorates compared with 15 leading recipients of funds for research and science education from principal Federal agencies, fiscal year 1964*

15 top producers of science doctorates	15 leading recipients of funds				
	National Institutes of Health	Department of Defense	National Science Foundation	National Aeronautics and Space Administration	Atomic Energy Commission
University of California	University of California	Massachusetts Institute of Technology.	University of California	Massachusetts Institute of Technology.	Columbia University.
Massachusetts Institute of Technology.	Harvard University	Johns Hopkins	Stanford University	University of California	University of California.
Purdue University	Columbia University	University of California	University of Illinois	University of Michigan	Massachusetts Institute of Technology.
University of Wisconsin	Johns Hopkins	University of Michigan	Harvard University	Princeton University	Yale University.
University of Illinois	University of Minnesota	Stanford University	University of Wisconsin	University of Chicago	University of Illinois.
University of Michigan	University of Washington	Illinois Institute of Technology.	Cornell University	University of Maryland	California Institute of Technology.
Stanford University	Yale University	University of Illinois	Massachusetts Institute of Technology.	Stanford University	University of Rochester.
Harvard University	University of Chicago	Cornell University	Columbia University	Rice University	New York University.
Iowa State University	University of Wisconsin	Pennsylvania State University.	University of Minnesota	Harvard University	University of Washington.
Columbia University	University of Pennsylvania	Harvard University	University of Chicago	Georgia Institute of Technology.	Carnegie Institute of Technology.
University of Texas	University of Michigan	University of Pennsylvania	University of Michigan	University of Wisconsin	University of Michigan.
Ohio State University	University of Texas	Ohio State University	California Institute of Technology.	Texas A. & M. University	University of Wisconsin.
Princeton University	Stanford University	George Washington University.	University of Texas	Washington University	University of Chicago.
New York University	New York University	California Institute of Technology.	University of Colorado	University of Florida	University of Minnesota.
Cornell University	State University of New York.	University of Chicago	University of Washington	University of Alabama	Purdue University.
Number of institutions among 15 top producers of science doctorates.	8	7	10	7	8.

But perhaps Federal science funds are now going in greatest volume to the top producers of science Ph. D.'s? This, too, does not appear to be the case. When the leading recipients of Federal funds for research and science education are ranked for the 5 Federal agencies accounting for 90 percent of all Federal funds to educational institutions, the top 15 in no case coincide with the top 15 producers of the Nation's science doctorates. As table VI shows, four out of the five agencies had only about half of the top producers of doctorates among their respective lists of major recipients of Federal funds. Only the National Science Foundation managed to have as many as 10 institutions as major recipients of funds which were also among the leading Ph. D. producers.

Moreover, even when funds are directed to universities which rank high as Ph. D. producers, there appears to be no relationship between the amount of funds and the number of Ph. D.'s. According to figures appearing in appendix table A, the University of California received a total of $88,987,000 from the five principal Federal agencies in fiscal 1964; the University of Wisconsin, $27,901,000; Purdue University, $8,540,000; and Iowa State University, $910,000. California produced 359 science doctorates; Wisconsin, 155; Purdue, 180; and Iowa State, 127. Thus, California produced 2.3 times as many doctorates as Wisconsin but received more than 3 times as much money; it produced twice as many doctorates as Purdue but received more than 10 times the money; and it produced 2.8 times as many doctorates as Iowa State but got nearly a hundred times the amount of money.

2. NO CLOSE RELATIONSHIP IS DISCERNIBLE BETWEEN THE VOLUME OF FEDERAL SCIENTIFIC RESEARCH FUNDS AND DIFFUSION OF SCIENTIFIC GRADUATE STUDIES TO MORE INSTITUTIONS

The view of the Office of Science and Technology that Federal funds are responsible for our having "many more students in more schools producing more science" [70] is also open to question. The National Academy's study concluded that the diffusion of graduate studies among an increasing number of institutions has been going on steadily for at least the last 40 years. The 10 leading doctorate producers accounted for about 66 percent of the Ph. D.'s in 1920, 40 percent in 1950, and 33 percent in 1960. Since the deconcentration of the earlier years in this period cannot be attributed to Federal support of the sciences, the continuation of the long-term trend in more recent years must also be otherwise explained. Actually, Federal science funds may well have worked against the long-term trend, since they are now more concentrated in leading institutions than they were at the beginning of the Federal program. Harold Orlans [71] has estimated that the top 20 universities received 32 percent of the funds in 1948, and 58 percent in 1954. A college president recently testified that the top 20 universities now receive 60 percent of the funds.[72]

[70] Subcommittee hearings, p. 96.
[71] Harold Orlans, "The Effects of Federal Programs on Higher Education," op. cit., p. 308.
[72] Robert C. Edwards, president, Clemson University, testimony before the Senate Subcommittee on Labor and Welfare, June 3, 1965.

TABLE VII.—*Percent of new full-time teachers having doctor's degrees, by field, 1953–54 through 1964–65*

Field	1953–54	1954–55	1955–56	1956–57	1957–58	1958–59	1959–60	1960–61	1961–62	1962–63	1963–64	1964–65
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Agriculture	34.9	33.7	33.0	23.8	35.0	30.1	37.7	35.0	42.0	41.1	52.4	49.4
Biological sciences	54.5	60.1	56.5	51.2	53.6	49.0	49.1	48.2	53.1	51.7	52.2	50.2
Business administration	21.4	17.3	13.1	8.8	17.4	11.4	14.3	15.8	17.8	17.7	21.9	20.1
Education	36.5	36.7	35.2	31.4	31.0	30.8	32.4	31.5	32.3	36.3	34.6	32.3
Engineering	15.9	14.4	12.9	11.1	13.2	15.8	23.2	25.9	31.0	29.0	42.6	45.1
English	29.0	23.4	18.9	17.7	16.8	13.7	13.6	13.6	13.5	12.6	13.8	10.9
Fine arts	12.2	9.4	8.9	9.8	10.0	9.2	7.3	10.2	11.4	9.2	8.8	9.8
Foreign languages	36.3	32.5	35.6	27.9	31.4	27.0	24.6	21.3	21.9	18.7	19.8	17.3
Geography	40.9	21.0	24.3	27.3	22.9	29.8	32.9	17.1	25.8	15.4	24.0	15.2
Health sciences [1]	34.2	22.3	31.0	22.8	27.2	25.9	17.1	18.9	18.2	13.7	17.8	20.0
Home economics	21.0	11.1	7.4	6.0	13.5	8.1	11.4	10.7	12.9	12.9	11.9	5.9
Industrial and vocational arts	7.8	14.3	6.1	7.0	4.1	13.5	7.4	8.2	7.4	16.5	2.2	8.0
Journalism	18.2	17.4	5.4	2.8	9.5	4.1	8.9	13.5	4.3	9.3	8.5	5.9
Law	31.8	29.2	33.3	27.7	15.8	17.4	20.0	17.8	23.3	18.7	10.6	18.8
Library science	1.2	2.1	5.1	3.0	2.5	5.1	11.3	1.8	3.4	4.9	7.9	5.3
Mathematics	34.2	29.3	27.3	20.5	20.7	20.0	19.7	22.2	23.1	20.6	27.4	28.2
Philosophy	46.7	41.6	51.9	38.4	40.0	34.7	40.3	40.0	29.7	28.6	26.4	26.8
Physical and health education	10.3	6.1	5.3	5.0	5.0	4.6	5.3	5.5	5.7	4.9	4.4	4.5
Physical sciences	53.0	46.9	46.3	43.7	48.5	44.3	49.0	47.4	53.8	51.1	57.3	59.1
Psychology	68.4	62.5	59.2	55.3	53.9	51.6	60.6	51.9	52.7	48.4	52.5	61.3
Religion	36.6	32.0	38.4	34.1	32.0	30.2	37.2	27.6	31.3	34.6	36.7	30.8
Social sciences	42.4	44.9	41.5	33.7	35.9	33.6	34.9	35.9	33.8	29.2	31.0	27.9
Others	----------	16.7	----------	----------	11.8	9.5	24.2	24.7	23.9	15.8	17.0	13.2
All fields	31.4	28.4	26.7	23.5	25.3	23.8	25.9	25.8	27.3	25.4	28.3	27.2

[1] Does not include dentistry and medicine.

Source: National Education Association, Research Division. "Teacher Supply and Demand in Universities, Colleges, and Junior Colleges, 1963–64 and 1964–65," research report, 1965–R4, April 1965, p. 17.

What about the quality of teachers?

In a letter of June 25, 1965,[73] supplementing its testimony before the subcommittee, the Office of Science and Technology cited National Education Association data on new college teachers with doctorates in support of its position that Federal science funds are responsible for an improvement in the quality of college faculty in the sciences. The OST included comparative figures for the academic years 1959–60 and 1964–65 for selected fields, and stated that

> * * * those fields which receive Federal support have increased the proportion of Ph. D.'s in new college hirings, in some cases dramatically, while in those fields which have not received substantial Federal funds for research the proportion (which is already substantially lower) has declined.

The complete table, here reproduced as table VII, shows, however, that comparisons of figures for different years and other fields do not as conveniently support these conclusions. For example, between 1954 and 1965, the proportion of new teachers holding the Ph. D. fell from 60.1 percent to 50.2 percent in the heavily supported field of the biological sciences. Mathematics, which also received substantial assistance throughout the period covered by the National Education Association figures, shows a decline in the proportion of new teachers with the Ph. D from 34.2 percent in 1954 to 19.7 percent in 1960, and then a partial recovery to 28.2 percent in 1965. Business administration, which has received no assistance from Federal science funds, increased its percentage of new teachers with doctorates from 8.8 percent in 1957 to 20.1 percent in 1965.

3. NO CLOSE RELATIONSHIP IS DISCERNIBLE BETWEEN THE VOLUME OF FEDERAL SCIENTIFIC RESEARCH FUNDS AND IMPROVEMENT IN THE QUALITY OF UNDERGRADUATE TEACHING GENERALLY

The lack of relationship between educational institutions receiving substantial Federal science funds and those giving the highest quality of undergraduate education appears even more pronounced.

While the quality of education is admittedly difficult to measure, one objective measure is the frequency with which an institution's students win prizes and awards for graduate study. Of course, the largest private and public institutions tend to win the largest total numbers of such awards because they have the largest enrollments. But the factor of size can be eliminated by looking at award winners in terms of their percentage of all those earning bachelor's degrees at each institution—the higher that percentage, the greater the quality of education in terms of this index of quality.

The American Council on Education made this study for colleges and universities from which some 12,500 winners of national competitive fellowships had received their bachelor's degrees in the 4 years, 1960–63, inclusive. The fellowships included were those of the Woodrow Wilson Foundation, the National Defense Education Act, and the National Science Foundation. Table VIII lists the top 50 colleges and universities ranked in order of their ability to turn out winners of fellowships from these sources as a percentage of all baccalaureate degrees awarded by them during the 4 years.

[73] See subcommittee hearings, p. 125.

affiliated with major institutions will tend to be selected. Because of their lighter teaching loads, they will have had greater opportunities to engage in research. Moreover, they will have had a more compelling experience record for, as senior investigators, they will have had previous grants accepted; or, as younger investigators, they will have had opportunities to work on projects headed by luminaries in the field.

In addition, if new proposals are judged on the basis of facilities available to scientists, those research centers which have accumulated facilities for use on previous projects will have a great advantage.

Dr. George E. Pake, provost of Washington University, in a letter to the subcommittee, described the cumulative advantage of institutions approved for research projects with the following illustration:

> If two institutions A and B vie for the same federally supported research project, and if institution A had higher competence than institution B in this research field, it is proper enough that institution A receive the project. But let us suppose that institution B is a developing institution, one which the Nation urgently needs to have take its place up among quality universities of the land. One must now face the fact that the award of the initial grant to institution A places institution B in an even worse competitive position the next time it seeks a project in this field. It is clear that the overall development of a strong university system for the United States is an important consideration, and the promise for future development of a strong scientific program may sometimes be a valid reason for awarding Federal research support to one institution when another may actually at that moment have somewhat higher competence in the same field.[77]

It is evident that criteria emphasizing research experience and existence of facilities will have just the effect which Dr. Pake deplores.

Even within the ambit of obtaining excellence in research, the trend toward concentration of research funds probably has been accentuated by imprecise definitions of selection criteria. The AEC, for example, passes on the "background and experience" of the principal investigator. This focuses on what the investigator has done and favors the research professional. The NIH, in comparison, seeks information on the "training, experience, and research competence *or promise* of the investigator or group of investigators." [Emphasis added.][78] This more explicit standard at least allows a scientist's potential to bear weight.

By the same token, NASA considers the "qualification" of the institution at which the research will be done on an apparent par with the qualification of the investigator. This broad term allows awards to be made on the general reputation of an institution when precise or compelling information is not available on the investigator. Compare again the NIH criteria which focus only upon "availability of facilities."[79] Certainly this is the most relevant factor in assessing the institution in relation to the project and should be the focus of attention.

[77] Responses (pt. 2), p. 348.
[78] National Institutes of Health, "Orientation Handbook for New Study Section Members, 1964," p. 5.
[79] Ibid.

In discussing this phenomenon, Dr. Kramer J. Rohfleisch, professor of history at San Diego State College, offered the following comment to the subcommittee:

> * * * Few if any of these institutions possess departments which would be rated "distinguished" in terms of having men who have gained Nobel prizes or places in the National Academy of Sciences. None boast of enormous libraries, or even of elaborate scientific equipment. But despite the lack of these badges of distinction, something is occurring which lies beyond the grasp of the great ones. They are teaching institutions. Their faculties perform their research too, but it is superimposed upon their task of teaching.[74]

Dr. Rohfleisch went on to point out that if Berkeley had produced fellowship winners at the rate achieved by Oberlin, Berkeley would have had 1,728 winners instead of the 132 which it actually achieved. At the Swarthmore rate, Berkeley would have had 2,790, and the University of Michigan, 2,325 awards. At the enormous rate achieved by Reed College of 72 awards among 600 students, Berkeley would have had 3,240 fellowships.

D. Such Concentration Has Come About by the Way in Which the Federal Research Programs at Higher Education Institutions Have Been Administered

The objective of federally supported research, whether by contract or grant, is the most research at the least cost. That this is the present orientation of the project system is evident from the criteria used by the departments and agencies to choose project proposals for support.

NASA uses the following general guidelines in the selection of its project awards:

> * * * the technical and programmatic significance of the planned research, the scientific or engineering merit of the proposal, the qualification of the principal investigator and his institution, and the cost of the project.[75]

The criteria of the AEC are substantially the same as those of NASA:

> * * * In selecting proposals for basic research, emphasis is chiefly placed upon the scientific merit of the proposal, its pertinence to the AEC mission, the background and experience of the principal investigator(s), and the facilities and other capabilities of the institution submitting the proposal. * * *[76]

There can be no doubt but that these criteria are defined for the exclusive purpose of purchasing research.

The objective of buying research to the exclusion of other considerations will lead inexorably to the concentration of Federal research funds at the major research universities. If proposals are judged on the basis of the previous research experience of investigators, scientists

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[74] Responses (pt. 2), p. 515.
[75] Letter to subcommittee dated Aug. 6, 1965.
[76] Atomic Energy Commission memorandum, "AEC Research Proposal Procedures for University Contracts," prepared for the subcommittee.

TABLE VIII.—*Percentage of winners of national fellowships among all baccalaureate degrees awarded 1960–63, inclusive*

	Percent
1. *California Institute of Technology*	20.1
2. Reed College	18.4
3. Haverford College	11.9
4. Swarthmore College	11.0
5. Carleton College	8.4
6. *Massachusetts Institute of Technology*	7.5
7. Wabash College	7.1
8. Cooper Union	6.9
9. University of the South	6.7
10. Queens College	6.5
11. Bryn Mawr College	6.2
12. Pomona College	6.0
13. Wesleyan University	6.0
14. *University of California, Riverside*	6.0
15. Hamilton College	5.8
16. *Harvard University*	5.7
17. *Princeton University*	5.6
18. Kenyon College	5.6
19. Kalamazoo College	5.5
20. *University of Chicago*	5.4
21. Antioch College	5.4
22. Amherst College	4.8
23. Knox College	4.8
24. Rice University	4.6
25. Oberlin College	4.6
26. *Case Institute of Technology*	4.1
27. Southwestern at Memphis	3.9
28. *Yale University*	3.8
29. *Yeshiva University*	3.7
30. Davidson College	3.5
31. *Rensselaer Polytechnic Institute*	3.5
32. Radcliffe College	3.5
33. Stevens Institute of Technology	3.5
34. Lawrence College, Wisconsin	3.4
35. Millsaps College, Mississippi	3.4
36. *Polytechnic Institute of Brooklyn*	3.4
37. *Tulane University*	3.3
38. *University of California, San Francisco*	3.3
39. *Cornell University*	3.2
40. Grinnell College	3.2
41. Brandeis University	3.1
42. Beloit College	3.0
43. *Johns Hopkins University*	2.9
44. *Carnegie Institute of Technology*	2.9
45. Wellesley College	2.9
46. Brown University	2.9
47. Dartmouth College	2.8
48. Williams College, Massachusetts	2.8
49. Wofford College	2.6
50. Occidental College	2.5

It will be noted that only 16 of the institutions on this list are among the Federal agencies' major recipients of science funds (those italicized). Most of the top recipients of Federal funds (shown in appendix table A) are conspicuous by their absence from the list. The University of California at Berkeley, Columbia University, and a number of the great State universities are among those absent. On the other hand, there are 34 institutions on the list which are mainly small liberal arts colleges whose excellence in turning out future scholars is negligibly, if at all, recognized in the distribution of Federal science funds.

It is interesting to note (though no causal relationship necessarily exists) that of the three agencies AEC, NASA, and NIH, in 1964, NIH disbursed less of its research and education funds to 25 top-ranking institutions than did the other 2.[80]

The tendency toward concentration of research funds has also been greatly accentuated in another way. The departments and agencies have used their increased research budgets to make larger awards instead of making larger numbers of smaller awards. The NIH distributed $27 million in 2,700 awards in 1955, an average of $10,000 per award. In 1964 it distributed $387 million in roughly 12,000 awards, some $30,000 per award. Over this 10-year period the amount of money distributed increased fourteenfold, while the number of awards increased only four times.[81]

In a similar manner the Atomic Energy Commission distributed 784 awards in 1957, of which 70 percent were in amounts less than $20,000. Of the 1,034 awards it made in 1964, less than 40 percent were under $20,000 and less than 60 percent under $30,000.[82]

The policy of using increased research funds mainly to enlarge the amounts of awards, rather than their numbers, has also been followed by the National Science Foundation. In 1952, over 50 percent of its awards were in amounts less than $10,000. In 1963, only 14 percent were under $10,000, while less than 45 percent were under $25,000.[83] Since 1957, the amount of funds distributed by NSF has increased over seven times while the number of awards has only tripled.[84]

These figures also indicate that increases in research funds have largely added to the benefits of a favored minority rather than been dispersed in small amounts to widen the research base. The National Science Foundation, for example, in the period from 1957 through 1964 in which it increased the number of its awards by a factor of 7, increased the number of institutions at which research was being done by only 17 percent.[85] Not only, then, are awards increasing in size to a much greater extent than in number, but also the proportionately smaller number of larger awards are being given to an overwhelming extent to persons affiliated with the same institutions which have in the past received the lion's share of the research support.

E. Recommendations

1. The system of awarding projects should be modified by adopting educational criteria so as to diffuse awards to more institutions, in wider geographical areas.

The project award is and should remain the backbone of our research support program. It has proved a singularly successful administrative device for melding the individual initiative of the scientist and the vast financial resources of the Federal research program. It has allowed the basic support decision to be made on the basis of specific scientific merit as judged by a panel of experts rather than by a university administrator dispensing Federal funds. It has also reserved to the university scientist the decision concerning how

[80] See table IV, p. 30.
[81] See appendix, table B, p. 63.
[82] See appendix, table C, p. 64.
[83] See appendix, table D, p. 65.
[84] See appendix, table E, p. 66.
[85] See ibid.

much time he wishes to devote to research and how much to his professional duties as a teacher.[86] But if there is to be a deconcentration of research support at graduate institutions in the interest of bridging the enlarging gulf between the quality of science education and research at the large institutions and at the remainder, it is necessary to make some alterations in its present administration.

Moreover, to define with greater precision the criteria designed to produce excellence in research, or to call attention to the disproportionate use of increased research funds to fund larger grants at a few select institutions is not enough. The departments and agencies should be charged in defining their award criteria to consider the beneficial effects of research activity on the quality of science education at the institution where the research is carried on.[87]

In keeping with its statutory charge "to strengthen basic research and education in the sciences,"[88] the National Science Foundation alone has utilized some educational criteria in awarding its project grants. In addition to detailed criteria bearing on the scientific merit of the project, it considers "the contribution which the research will make to science education and training, particularly at the graduate level. This is generally judged on the basis of proposed student participation in the work."[89]

Another factor which the National Science Foundation takes into account is "the extent to which the research will stimulate the total science enterprise of the institution.* * *"[90]

These very general criteria undoubtedly reflect an effort by the National Science Foundation to come to grips with the concentration problem. Again, it is of interest to note that in 1964 the NSF concentrated 40 percent of its research and education funds at the 25 universities which it most favored, while the other departments and agencies all concentrated at least 58 percent of such funds at their 25 largest grantees.[91]

It is, nevertheless, clear from the relatively high degree of concentration of NSF funds that the present criteria are not sufficient. More specific guidelines to give greater weight to the educational aspects of project awards are needed. In addition, a revision should be made in scientific criteria which discriminate against the small university or college without justification in terms of achieving excellence in research.

Neither the mission-oriented departments and agencies nor the National Science Foundation are to be greatly criticized for an orientation, exclusively or in the main, toward excellence in research in their project programs, for their project funds have heretofore been appropriated primarily for research. Nevertheless, the subcommittee believes that in the future there is an imperative need for better balance between the needs of both research and education. Specifically, ex-

[86] See generally, National Academy of Sciences, "Federal Support of Basic Research in Institutions of Higher Learning," 1964, pp. 76–77.

[87] The subcommittee received numerous letters expressing the opinion that research activity was absolutely necessary for first-rate teaching. See e.g., Responses (pt. 2), pp. 122, 215, 238.

[88] 64 Stat. 149.

[89] Statement of criteria prepared by Dr. Lewis Levin, head, Office of Program Development and Analysis, National Science Foundation, appendix, p. 59. The subcommittee understands that no such formal statement of criteria is in administrative use at the Foundation.

[90] Ibid.

[91] See table IV, p. 30.

cellent research projects should be supported at the large universities (or wherever else they may be found); but, in addition, a decent proportion of the project money should be awarded on the basis of scientific excellence and criteria reflecting the contribution of the project to both graduate and undergraduate education.

To this end, the subcommittee suggests that the following guidelines be established for the use of program directors in the selection of proposals for support. Where panels of outside experts are utilized, they should continue to be asked to judge proposals on the basis of scientific merit, but a second screening should then be made by the program director, applying educational guidelines as well as the present budgetary considerations. Such guidelines should be set forth in directives to program directors in which criteria for judging research proposals are defined, and relative weights attributed to them.

We recommend that substantial weight should be given to project proposals which will strengthen the scientific programs at the educational institutions with which the investigators are affiliated.

Such a criterion will help to reverse the trend toward research funds concentration, a reversal which the subcommittee considers of greatest importance. Within reason, those institutions which stand to gain research experience and/or to obtain research facilities through the receipt of research funds by one of their faculty should be given special consideration. This may mean an increase in research project costs in some cases, for while a leading institution may already have all the necessary equipment for a project, a developing institution may not. Some of the additional cost, however, could be covered by institutional grants, appropriate for financing equipment having general research and teaching use. The subcommittee believes that only when the economic costs of a project are unreasonable because of the need for expensive equipment should weight be given to "the adequacy of available facilities, equipment, assistance, and other ancillary aids needed for the conduct of the research" [92] or similar criteria.

Substantial weight should also be given to project proposals which will employ undergraduate and graduate students.

The point was made by many correspondents that research and teaching are complementary activities, and most directly so when students are working on a project of original research in the laboratory.[93] To realize the full potential of this educational experience, investigators should be encouraged to maximize the participation of students in the research laboratory. The neophyte should be admitted to the science sanctuary.

Dr. James R. Killian, chairman of the Massachusetts Institute of Technology Corp., testified that MIT has been successful in bringing undergraduates into research projects.[94] A more general use of undergraduates as well as graduate students on research projects would certainly strengthen the teaching process, help compensate for the impersonality of the large lecture, and motivate more baccalaureates to continue their training with graduate work in the physical sciences.

The subcommittee believes that significant and oftentimes decisive weight should be given to these proposed guidelines of aiding education and of employing graduate and undergraduate students in re-

[92] National Science Foundation, "Statement of Criteria," op. cit., appendix, p. 59.
[93] See e.g., Responses (pt. 2), pp. 290, 407, 477.
[94] Subcommittee hearings, p. 45.

search activity, so that in many cases receipt of an award will hinge on the degree of beneficial effects of such an award on the institution's science program and/or on the number of students gaining research experience. Such criteria should not be applied on an "other-things-being-equal" basis alone, for such equality seldom exists. Improvement of science education should be a major goal of all project award programs and, accordingly, effects of a project favorable to science education should often be of decisive importance. If any department or agency doubts that it has statutory authorization to use educational criteria in making its awards, the department or agency should prepare and request such authorization.

With the great need for science teachers and the distressing desire of many scientists to accept only minimal teaching loads, it is irrational to add another burden to those shouldering the teaching responsibility; namely, to deprive them of opportunities to receive project awards. Moreover, if a premium is put on an investigator's carrying a light teaching load, this is another factor favoring concentration of research at the large research-wealthy universities where teaching burdens are least heavy. The experience cited by Dr. Burmeister of the rejection of a proposal submitted by a faculty member at Trinity University because of his teaching load, which was considered by the National Science Foundation to be too great, indicates that such discrimination does currently exist.[95]

What is to be gained if a basic research project is completed in 1 year by a scientist with a minimal teaching load at a large university rather than in 2 years by a scientist with a heavier teaching load at a college or small university? In basic research devoid of immediate mission and far removed from the time pressures of high priority development programs, time is not of the essence. Some educated guess, moreover, can be made of the risk that the proposed project will be scooped or made obsolete if the research period is an "extended" one. The subcommittee believes that "the amount of time and effort the investigator will devote to the work,"[96] or similar criteria, should be given weight only in extraordinary cases in which there is doubt as to the seriousness of the intent of the investigator, his workload is excessive by any reasonable standard, or there is a substantial risk that the project will be of little value upon the proposed date of completion.

Important consideration should also be given to distributing project awards over a wider geographic area. The immobility of many undergraduates and the cultural advantages of research to the locality make it imperative that an effort be made to build up research centers in a wide variety of university communities.[97]

There is no indication that the increased emphasis on educational aims by utilization of these criteria in the selection of projects will adversely affect the quality of scientific research supported by the project award program. For example, the National Science Foundation has stated that more than one-half of some 2,915 proposals declined or withdrawn during 1964 were for worthwhile projects which would have been supported if more funds had been available. It was also acknowledged that many of the proposals declined were from smaller

[95] See supra, p. 31.
[96] National Science Foundation, "Statement of Criteria," op. cit., appendix, p. 59.
[97] See supra, p. 32.

schools "where an award would have given valuable impetus to the scientific program at the institution and where a declination almost surely had a most discouraging impact."[98] A substantial shift of proposal acceptances could be made from large research institutions to smaller schools, therefore, without exhausting the supply of meritorious proposals.

The recommendation that educational factors be incorporated into the project system and given serious consideration is not a new departure. The National Science Foundation has already taken halting steps in this direction. It is now time to affirm this initiative by action by all departments and agencies to give significant weight to the educational benefits to be derived from Federal research activities.

2. **The system of awarding projects should be modified by making more representative the panels which judge the scientific merits of proposed projects.**

An additional factor which may be of importance in concentrating research funds is the composition of the panels of scientists who determine the scientific merits of research proposals. The danger associated with a narrow selection of panelists from major recipient institutions is a subtle one. As Dr. Mervin B. Freedman, assistant dean of undergraduate education at Stanford University, stated in a letter to the subcommittee: "When it comes to supporting researchers and research projects, these men are likely to choose in their own image."[99] Thus, a high energy physics panel composed of a majority of panelists from major research institutions is likely to rate high those research projects carried on in similar large institutions.

There is evidence that the scientific panels are to a high degree made up of scientists from the major research universities of the country. A survey of the present list of panelists from which the National Science Foundation draws its advisers shows that of the 271 members of 29 advisory panels, 25 are from the University of California; and the Universities of Illinois, Wisconsin, and Michigan are represented by from 5 to 10 panelists each. Only 113 institutions are represented. Only eight of the panelists represent non-Ph. D.-granting institutions. Virtually all panelists have themselves been, and some are now, recipients of Federal research awards.[100]

In a study made last year by the Elliott Select Committee, it was found that "in an examination of the composition of NIH panels in the last 5 years * * * 40 percent of the names occur again and again." The same report listed 10 institutions which in 1960–63 received 38 percent of Federal research funds; and of the 2,062 members then listed of Federal agency grant review panels, 759 were on the faculties of these 10 universities.[101]

The National Academy of Sciences (more than half of whose university-associated members are from the same 10 institutions[102]) in a review of the Federal basic research program in colleges and universities published last year stated:

> * * * We are convinced that infusion of new blood into the sections and panels is conducive to the maintenance of

[98] "14th Annual Report 1964," op. cit., p. 15.
[99] Responses (pt. 2), p. 223.
[100] See "14th Annual Report 1964," op. cit., pp. 97 et seq.
[101] Select Committee on Government Research, "Administration of Research and Development Grants," Study No. I, 88th Cong., 2d sess., 1964, pp. 18–19.
[102] Ibid.

chosen by the individual investigator. Under such an anarchic system gaps are created between projects, and important scientific areas left relatively underdeveloped at the institution. There is consequently a need for an appreciable amount of unfettered funds to be given universities to fill the interstices between disparate project research activities.

Thirdly, the NSF has developed the prototype "formula" program[111] which in fiscal 1964 distributed $11 million in institutional grants (about 10 percent of the amount distributed in project awards) to institutions where Federal research activity was carried on. This was done on a formula basis relating the amount of the institutional grant to the amount of the project award funds.[112]

NIH also has a general research support grant program through which it distributed $35 million to educational and research institutions in fiscal 1964.[113] NASA, too, has a small institutional grant program, the sustaining university program to which, in fiscal 1964, it obligated approximately $7 million.[114] DOD and AEC now make no university-controlled institutional grants.

The NSF, NIH, and NASA programs in fiscal 1964 totaled only approximately $80 million. (The science development program did not make its first grants until fiscal 1965, when funds totaling $28 million were available.) This represents an inconsiderable fraction of the $1.8 billion spent for research at universities (including their research centers) in the same year.

The subcommittee recommends an expanded institutional grant program to be undertaken by all agencies making awards for basic research. This program of institutional grants, supplementing the NSF development and "formula" programs, should have the objectives of wide dispersion of a substantial volume of funds in order to improve science instruction, to provide incentives for able scientists to remain at or to go to liberal arts colleges and smaller universities, and to restore to the major universities a measure of control over the research they undertake. If doubt exists concerning statutory authorization to make institutional grants on the part of any agency, the agency should prepare and request such authorization.

The Achilles heel of the institutional grant has been the "accreditation problem." Dr. Don K. Price, dean of the Graduate School of Public Administration, Harvard University, stated the problem well in testimony before the subcommittee:

> If you are going to make grants for general education, the only standard you can have is the general quality of the institutions in question, and to make this decision on this basis is equivalent to going into the accrediting business. This is really a terrifying prospect.[115]

The fact is that no one desires that a department or agency undertake to make a judgment concerning the scientific excellence of an academic institution.

Thus, the subcommittee suggests two objective standards which may be utilized in awarding such grants. Though these standards

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[111] 14th Annual Report, 1964, op. cit., pp. 5–7.
[112] The formula is set forth in footnote 116, infra.
[113] Information supplied to subcommittee by NIH.
[114] Subcommittee hearings, p. 106.
[115] Subcommittee hearings, p. 69.

that it would "to some extent * * * have the effect of providing a wider distribution of funds."[105]

In the spring of 1965, the first four awards were announced under the development program. They went in amounts of approximately $4 million each to four institutions—Washington University, St. Louis; Western Reserve University and Case Institute of Technology, Cleveland; and the University of Oregon, Eugene. That each is deserving and will make effective use of the grant funds is not doubted. None of these institutions, however, are research deprived; three of the four, in fact, rank in the top 40 institutions in terms of Federal research money received.[106]

Henry W. Riecken, Associate Director of the National Science Foundation, testified that the program was geared in part to building up departments

> * * * in an institution that has one or several excellent departments [but in which] there may be very serious weaknesses in ancillary activities in related departments. We think of a center of excellence as an institution that is as much as possible uniformly excellent. A major part of our effort in the science development program is to raise the level of excellence everywhere in the institution.[107]

With these objectives, it is clear that the rich will continue to get richer despite the development program. The subcommittee believes that, given the necessarily limited funds available to the program, the net ought to be cast more widely, and emphasis should be placed on improving developing institutions rather than lagging departments within already important research institutions.

The subcommittee hopes that, as Mr. Riecken assured it, the first four grants have not defined the NSF's intentions; that the agency will not limit, or indeed use a preponderance of, its program money to improve science at large universities with well-established research programs; and that it will move into the 4-year college group, not "at some point,"[108] but soon.

Secondly, the NSF has undertaken a graduate science facilities program which for fiscal 1960–64 granted approximately $96 million to 152 graduate institutions throughout the country on a selective basis.[109] The continuation and expansion of the program will obviously greatly aid in equalizing science facilities at graduate institutions.

Increased institutional grants would have a second salutary result. They would restore to the universities presently receiving project grants a measure of control over the direction of research undertaken there. Some universities receive 90 percent of their total research funds from project awards.[110] Research is conducted in scientific areas

[105] 14th Annual Report 1964, op. cit., pp. 3–5.

[106] Hon. Edith Green. "The Federal Government and Education," 88th Cong., 1st sess., 1963, p. 50. In a 1965 survey of university research conducted by Industrial Research magazine both Washington University and Western Reserve University ranked 23d among recipients. The University of Oregon which was the other institution in the top 40 on Mrs. Green's list was not included in the survey. ("1965 I–R Survey of University Research," Industrial Research, vol. 7, No. 4, April 1965, pp. 48–49). Case Institute of Technology, which was not included in Mrs. Green's list, was 69th in the Industrial Research survey. It was among the top 30 recipients of both AEC and NASA funds in fiscal 1964. See appendix, table A and subcommittee hearings, p. 156.

[107] Subcommittee hearings, p. 123.

[108] Id. at p. 124.

[109] Fourteenth Annual Report 1964, op. cit., pp. 8–12.

[110] E.g., The University of Oregon received 87 percent of its fiscal 1964 research funds from Federal sources. Letter to subcommittee dated May 24, 1965.

high scientific standards and helps to induce the selection of the most original and promising research proposals.[103]

The Academy also recommended that younger scientists be given wider representation on the panels to inject new points of view, a recommendation with which the subcommittee is in agreement.[104]

The subcommittee recommends that the departments and agencies which utilize panels for project awards should adopt a policy of composing panels so that they will reflect a cross section of the scientific community. Scientists associated with small colleges or universities, as well as those associated with large universities, younger as well as more senior scientists, should be included in the membership of all panels.

With a concentrated effort to expand the personnel on advisory panels, and with increased weight placed on criteria directly relating to the effect of a project award on the improvement of education at an institution, the trend toward greater concentration of research funds can be arrested and reversed. But other important steps also need to be taken to disperse research funds more widely and to strengthen science education.

3. **The system of awarding projects should be augmented by expanded programs of institutional grants.**

The alterations which the subcommittee has recommended in the project award system as presently administered will not of themselves be sufficient to restore balance to the research programs undertaken at our universities and colleges. Large universities have received, and to a lesser extent will continue to receive, a higher proportion of awards than small universities or liberal arts colleges at which undergraduate teaching claims a high portion of faculty time.

A larger institutional grant program is needed to give direct aid to institutions which cannot now effectively compete for project awards. Some institutions need to develop a base of scientific personnel able to devote a part of their energies to research, of clerical personnel, and of modern research equipment. Others, which wish to continue to devote their primary energies to teaching, need funds to increase their staffs so that they can offer talented young instructors time off for research and to procure modern equipment for laboratory instruction.

The NSF has already recognized the necessity for institutional aid to colleges and universities with three programs.

First, the Science Development Program of March 1964 is "designed to assist selected academic institutions in strengthening significantly their activities in science and engineering. The major objective of the science development program is to increase the number of institutions of recognized excellence in research and education in the sciences." The National Science Foundation has stated that despite its intent to "help to build scientific strength in additional geographical regions," the $28 million available in the first year (fiscal 1965) was not sufficient to satisfy "the demands for significant increases in funds in all geographic areas." But the National Science Foundation believes

[103] National Academy of Sciences, 'Federal Support of Basic Research in Institutions of Higher Learning" (1964), p. 2.
[104] Id., at p. 83.

provide only rough approximations of an institution's merit, they do give some indication; and they avoid any accreditation judgment: A first standard would be to award institutional grants in proportion to the volume of project awards received by an institution. This standard is particularly appropriate for institutional grants which supplement project awards.[116]

A second standard which may be used as an alternative to, or in conjunction with the first, is to award institutional grants to a college or university on the basis of the percentage of its bachelors of science who enter graduate school. This standard would be especially appropriate for deconcentrating Federal research support by distributing institutional grants to institutions which assume a large share of the responsibility of producing science baccalaureates.

The subcommittee believes that the institutional grant, today in a rudimentary stage of development, is a viable and appropriate instrument for supplementing the project award system. The NSF Science Development Program and its "formula" program testify both to the need for and the utility of institutional grants. For institutional grants to come of age, it is now necessary for all departments and agencies making project awards to incorporate institutional grants into their basic research programs.

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[116] The NSF has for several years utilized the following formula for allocating institutional grants as a function of project awards. The 1964 formula was:

Institutional grants were correlated with project grants to the extent of 100 percent of the first $10,000 of project research grants, 10 percent of the amount awarded from $10,001 to $1,200,000, 1 percent of the amount awarded from $1,200,001 to $3,000,000 and 0.5 percent above $3,000,000 to a maximum institutional grant of $150,000.

Fourteenth Annual Report, 1964, op. cit., p. 6.

VI. THOSE FEDERAL RESEARCH AND DEVELOPMENT PROGRAMS DIRECTED AT SCIENTIFIC RESEARCH IN UNIVERSITIES AND COLLEGES HAVE NECESSARILY NEGLECTED THE SOCIAL SCIENCES AND HUMANITIES

Educational institutions receiving substantial Federal money for science must have resolute administrators and ample outside money to maintain a balance between the natural sciences and other areas of instruction. This is not an easy task, since nearly all Federal research money is earmarked for the natural sciences.

In the fiscal years 1963, 1964, and 1965, the physical sciences received 68 to 69 percent of all Federal support of basic research; the life sciences, 26 to 28 percent; the social sciences, about 2 percent; and all other fields, less than 0.5 percent.[117]

Since universities and the research centers they administer are the recipients of about half of all basic research funds, their Federal science funds reflect the general pattern—nearly all for the physical and life sciences and very little for anything else.

Dr. Walter P. Metzger, professor of history at Columbia University, informed the subcommittee that one-half of the operating budget of Columbia University is supplied by Federal grants, and that almost all of such grants were committed to the sciences. By way of contrast, the humanists at Columbia receive only a $20,000 annual grant which is made by the trustees of the university.[118]

The subcommittee believes that such a disproportionate allocation of support for the natural sciences will not only be detrimental to the humanities (including the arts) and social sciences, but in the long run will harm the natural sciences as well. Harvard University, which has been eminently successful in maintaining balance among departments, emphasized in a 1961 study that creative research and teaching cannot flourish if the Federal Government does not consider the intellectual and academic diversity which is of the essence of a university.

> For research can be carried on effectively in the long run only if a university maintains its overhead in an intellectual and academic, as well as an administrative, sense. This is the case for asking the Government to support basic as well as applied science, and teaching as well as research. It is not a question of asking the Government for more money, but, rather, of asking it to give its funds with a proper regard for the total function of the university.[119]

[117] National Science Foundation, "Federal Funds for Research, Development, and Other Scientific Activities, Fiscal Years 1963, 1964, and 1965," vol. XIII, p. 12.
[118] Responses (pt. 1), p. 57.
[119] A report to the Faculties and Governing Board of Harvard University, "Harvard and the Federal Government," 1961, p. 22.

Dr. Arnold Arons, professor of physics at Amherst College, made the same point in correspondence with the subcommittee, citing his personal experience while advising a Latin American university on its educational program for the Rockefeller Foundation.

> * * * The foundation had been supporting the medical school of a young university. They soon began to see that in supporting the medical school alone they were vitiating their own purposes. In order to have a thriving, viable medical school there had to be a strong university surrounding it—a university with strong faculty in areas besides medicine and with students well educated in subjects other than chemistry and biology.[120]

Though the disparity between the funds available to universities for science as compared with those at hand for the humanities has not for the most part created differences in basic pay scales,[121] it has created vast discrimination in lucrative summer research and teaching opportunities and in other perquisites of significance.

Federal programs give a monetary advantage to the scientist. Grants for summer research projects provide an opportunity for him to augment his salary by two-ninths, whereas similar opportunities are rarely available to the humanist. Thus, while a scientist can spend his summer doing research which freshens and enlivens his mind for the academic term ahead, the humanist must find other employment which may disrupt or postpone his research plans.

To redress the balance, Yale University has instituted a program whereby any instructor or assistant professor in the arts and sciences automatically receives $1,000 in addition to his salary if he engages in uncompensated research for at least 2 months during the summer.

Not only are opportunities to augment his salary greater for the scientist. His teaching conditions and facilities are also often better. The scientist may be teaching 6 hours or less a week, while his counterpart in the arts department is teaching 9 to 12 hours. The scientist may be housed in a modern science building, while the "humanist" is crammed in an ancient campus relic. And the researcher in science may have someone to type his papers, while a scholar in the arts does not.

The heavy emphasis on the natural sciences has led to changes of emphasis in other fields which are of concern to educators.

President Brewster, of Yale University, has pointed to a subtle and dangerous influence of the heavy concentration of Federal funds in support of certain areas within a discipline, such as the NSF's concentration on problems that can be quantified in the social sciences.[122] The danger is that the research projects undertaken by persons working in the field will be guided by the opportunity to gain

[120] Responses (pt. 2), p. 130.

[121] But cf. the following experience of Norman S. Care, instructor, Department of Philosophy, Yale University: "The earning advantage of the scientist has also become a feature of academic salaries themselves. In one encounter with a college dean I learned that in his thinking there are substantial differences between salary ranges for scientists and humanists. When he asked me what I thought to be a decent starting salary for an instructor in philosophy with a completed Ph.D. and I replied with what I considered a reasonable figure ($7,500 to $8,000), he cautioned me 'not to talk like a physicist'." Responses (pt. 1), p. 23.

[122] See 14th Annual Report, pp. 35–38.

research funds rather than by individual judgments as to the intrinsic worth of the projects:

> However, in many fields, especially the social sciences, career choice, or the decision about what line of scholarship to pursue, is almost inevitably distorted by the knowedge that one line of inquiry is eligible for support and will bring in $2,000 or $3,000 more income, whereas another must, at worst, be wholly without research compensation, or at best, take the chance of ad hoc summer grants from foundations or university fluid research funds.
>
> These pressures and temptations are greatest at the very beginning of an academic career, when the young instructor is for the first time charting his professional course, but has the least bargaining power because he is not yet visible to his peers or to public or private patrons who might screen his proposals.[123]

Dr. David Riesman, of the Department of Social Relations, Harvard University, warns of the same danger:

> * * * It is not so much that the "hard science" departments are being supported, but that the "hard" outlooks are being supported within every field, including the humanities. The academic judgments as to what is "research" and the judgments as to what are the appropriate methods for discovery, tend to become stereotyped as the result of the anxieties of young researchers lest they not be pursuing the approved formulas—approved, that is, within their academic subguilds. Throughout American life, and not only in the academic and research world, there is a search for easily grasped standards of performance which avoid the making of difficult qualitative judgments.[124]

Dr. Robert Lekachman, a specialist in economic history and theory, resigned this year from the faculty of Barnard College at Columbia University because of the university's tendency to be "excessively attached to econometric and mathematical techniques" to the exclusion of "historical and societal" analyses of economic problems.[125]

A. Recommendation

The subcommittee recommends that massively increased support for scholarship and for instruction in the humanities and the social sciences—by private means, and by Federal, State, and local governments—be accepted as an important national goal.

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[123] Responses (pt. 2), p. 173.
[124] Responses (pt. 2), p. 389.
[125] The New York Times, Apr. 24, 1965.

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> However, in many fields, especially the social sciences, certain choices of the decision about what line of scholarship to pursue, is almost inevitably distorted by the knowledge that one line of inquiry is eligible for support and will bring in [illegible] research funds [illegible] take the [illegible] much greater grants from foundations or university research funds.
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[illegible] Responses (pt. 2), p. 172.
[illegible] Responses (pt. 2), p. 248.
[illegible] The New York Times, Apr. 24, 1965.

APPENDIX

PRINCIPAL CRITERIA APPLIED BY THE NATIONAL SCIENCE FOUNDATION IN EVALUATION OF RESEARCH PROPOSALS

The principal overall criterion used in evaluation of a research proposal is that of its intrinsic merit; i.e., the predictability that the proposed research, under the direction of the particular investigator, will result in significant advancement of knowledge in a field of interest and importance. A number of subcriteria or factors enter into such an assessment. These include:

(*a*) The significance and timeliness of the problem to be explored.

(*b*) The soundness of the proposed ideas, concepts, approaches, and methods; i.e., the probability that the planned research, properly executed, will produce definite answers to previously unanswered questions.

(*c*) The extent to which the proposed work duplicates or overlaps with other research in progress or already completed.

(*d*) The competence of the investigator to conduct the research in a profitable manner as judged by his background, training, experience, and research productivity record.

(*e*) The amount of time and effort the investigator will devote to the work.

(*f*) The adequacy of available facilities, equipment, assistance, and other ancillary aids needed for conduct of the research.

Account is also taken of the contribution which the research will make to science education and training, particularly at the graduate level. This is generally judged on the basis of proposed student participation in the work. The extent to which the research will stimulate the total science enterprise of the institution is an additional factor.

The justification for the financial request is carefully considered in terms of the total amount asked and sums budgeted for various categories and items as well as in terms of economy of approaches and methods to be used. In addition, consideration is given to other support available to the investigator for this or other projects.

The quality of the institution as a whole does not enter into consideration unless the merit of the proposal is of less than highest quality. Proposals of less than highest quality are rarely supported at institutions having highly developed research activity. However, not infrequently middle range proposals are supported at lesser institutions in order to encourage development and improvement of their research and instructional programs. Similarly, in cases of proposals of substantially equal merit, priority is given to those from the less well-developed institutions.

Source: National Science Foundation. Prepared for the subcommittee by Louis Levin, Head, Office of Program Development and Analysis.

TABLE A.—*The 25 top recipients of Federal funds for research and for science education from 5 principal agencies, fiscal year 1964* [1]

Rank					Institution	Amount (thousands of dollars)					
NIH	DOD	NSF	NASA	AEC		NIH [2]	DOD [3]	NSF [4]	NASA [5]	AEC [6]	Total
National total, all educational institutions						577,944	400,977	338,932	88,779	62,542	1,469,714
Total, top 25 institutions						336,365	306,218	135,507	57,325	43,404	878,819
	1	7	1	3	Massachusetts Institute of Technology		98,044	6,267	8,042	3,158	115,511
1	3	1	2	2	University of California	38,729	19,068	20,119	6,072	[7] 3,999	87,987
					Berkeley	(7,807)	(7,361)	(8,947)	(3,742)		
					Los Angeles	(15,768)	(2,793)	(4,642)	(1,444)		
					San Diego	(379)	(7,876)	(2,748)	(713)		
					San Francisco	(9,246)	(251)	(75)	(44)		
					Davis	(3,879)	(266)	(2,058)	(24)		
					Riverside	(1,344)	(360)	(856)	(35)		
					Santa Barbara	(105)	(161)	(744)	(70)		
					Irvine	(200)		(50)			
4	2				Johns Hopkins University	15,890	54,989				70,879
11	4	11	3	11	University of Michigan	13,071	17,642	4,723	4,510	1,749	41,695
13	5	2	7		Stanford University	12,398	14,555	10,670	2,979		40,602
2	10	4	9		Harvard University	21,412	5,852	7,397	2,431		37,092
18	7	3	17	5	University of Illinois	10,079	8,117	7,573	1,184	2,608	29,461
					Urbana		(7,784)				
					Chicago		(333)				
3		8	22	1	Columbia University	17,522		5,946	916	4,679	29,063
9	21	5	11	12	University of Wisconsin	13,327	3,681	7,241	1,961	1,691	27,901
8	15	10	5	13	University of Chicago	13,437	4,558	4,725	3,367	1,276	27,363
6	17	15		9	University of Washington	15,341	4,342	4,316		2,065	26,064
10	11	19	18		University of Pennsylvania	13,302	5,352	3,504	1,177		23,335
22	8	6		18	Cornell University	[8] 8,859	6,505	6,313		964	22,641
					Cornell University			(3,128)			
					Cornell University—State			(2,992)			
					Cornell University—Medical School			(90)			
					SUNY College of Agriculture—Cornell University			(81)			
					SUNY Veterinary College—Cornell University			(21)			
5		9	20	14	University of Minnesota	15,350		4,738	1,111	1,195	22,394
12	16	13			University of Texas	12,773	4,456	4,551			21,780
					Main University—Austin	(2,114)	(4,221)	(4,345)			
					M. D. Anderson Hospital and Tumor Center—Houston	(5,035)	(48)	(104)			
					Galveston	(2,752)	(139)	(39)			
					Dallas	(2,872)	(48)				
					Texas Western College			(38)			
					Institute of Marine Science			(24)			

7		16		4	Yale University	13,874		3,705		3,017	20,596
14	19			8	New York University	12,366	3,926			2,082	18,374
16		22		23	Duke University	11,680		2,847		708	15,235
	6				Illinois Institute of Technology		13,548				13,548
	14	12	24	6	California Institute of Technology		4,611	4,591	909	2,479	12,590
	20	20	4	20	Princeton University		3,762	3,410	4,179	914	12,265
15					State University of New York	[9] 11,755					11,755
					At Buffalo	(4,778)					
					Downstate Medical Center (New York City)	(4,067)					
					Upstate Medical Center (Syracuse)	(2,686)					
					At Stony Brook	(118)					
					At Albany	(40)					
					Harpur College	(33)					
					College of Forestry	(28)					
					At Plattsburg	(4)					
19			13		Washington University	10,010			1,408		11,418
17					Yeshiva University	11,195					11,195
21				7	University of Rochester	9,085				2,090	11,175
20					Western Reserve University	9,586					9,586
	9	21			Pennsylvania State University		5,930	2,962			8,892
23					University of Pittsburgh	8,825					8,825
24					Tulane University	8,754					8,754
	25	17	25	15	Purdue University		2,972	3,553	909	1,106	8,540
25					University of North Carolina	7,745					7,745
	24	26			University of Miami		3,299	2,716			6,015
	12				Ohio State University		5,210				5,210
		14		25	University of Colorado			4,486		666	5,152
	13				George Washington University		4,731				4,731
			6	19	University of Maryland				3,173	935	4,108
	18				Northwestern University		4,048				4,048
		23		22	Florida State University			2,838		744	3,582
	22				Brooklyn Polytechnic Institute		3,576				3,576
	23				University of Denver		3,544				3,544
		18			University of Syracuse			3,540			3,540
					University			(3,044)			
					Research Institute			(246)			
					SUNY College of Forestry			(230)			
					Utica College			(20)			
			8	24	Rice University				2,511	689	3,200
		24			Michigan State University			2,776			2,776
			10		Georgia Institute of Technology				2,384		2,384
			19	16	Rensselaer Polytechnic Institute				1,113	1,008	2,121
				10	Carnegie Institute of Technology					1,764	1,764
			12		Texas A. & M. University				1,441		1,441
			14		University of Florida				1,231		1,231
			15		University of Alabama				1,195		1,195
			16		Auburn University				1,194		1,194
			21		University of Arizona				1,018		1,018
				17	University of Notre Dame					1,007	1,007
			23		State University of Iowa				910		910
				21	Case Institute of Technology					811	811

See footnotes on p. 62.

[1] This table illustrates the top 25 recipients for each individual agency only. Hence, some institutions may receive Federal funds for research from 1 of the 5 principal agencies, yet no amount is shown if their rank falls below the 25 mark.

[2] Includes research grants, training grants, traineeships and fellowship awards, research career program awards, and construction grants.

[3] This list shows total of fiscal year 1964 contract awards, calendar year 1964 research grants and equipment grants, and calendar year 1964 title transfers of equipment; includes funding of research by contract research centers.

[4] Includes research grants and contracts, grants and contracts for science education, facilities grants and contracts, institutional grants, and $7,900,000 for Project Mohole. Excludes $12,700,000 for a variety of nonresearch activities and funding of Federal research laboratories.

[5] Does not include funds for Jet Propulsion Laboratory (California Institute of Technology).

[6] Includes amounts for nuclear education and training but excludes amounts for following university contract research centers: Ames Laboratory (Iowa State University), Argonne National Laboratory (University of Chicago), Brookhaven National Laboratory (9 universities), Lawrence Radiation Laboratory (University of California), and Los Alamos Scientific Laboratory (University of California).

[7] The Atomic Energy Commission provided no breakdown for the University of California branches and, therefore, no totals are shown for the individual campuses.

[8] Includes grants awarded to College of Agriculture, College of Home Economics, Veterinary College, of the State University of New York.

[9] Does not include grants to other components of the State University of New York which have been included with total shown for Cornell University.

TABLE B.—*Number and size of National Institutes of Health research grants to educational institutions, fiscal years 1955–64*

Year	Number	Research grants [1]	Average size
1955	2, 646	$26, 649, 625	10, 072
1956	2, 823	31, 263, 799	11, 075
1957	5, 011	60, 579, 976	12, 089
1958	[2] 5, 742	[2] 75, 434, 163	13, 137
1959	7, 158	104, 260, 293	14, 565
1960	[2] 9, 152	[2] 147, 450, 807	16, 111
1961	10, 807	210, 510, 276	19, 479
1962	12, 640	297, 948, 908	23, 572
1963	12, 455	348, 071, 603	27, 946
1964	12, 492	387, 138, 300	30, 991

[1] Includes all foreign institutions receiving research grants, not only foreign universities and colleges. Total research grant awards to foreign countries averaged 3.7 percent annually ($13,000,000) of all NIH research grants in the 1961–63 period. Most of these funds, however, went to universities and colleges.

[2] Data represent Public Health Service grants and awards.

Source: Science Information Exchange.

TABLE C.—*U.S. Atomic Energy Commission, research and development at educational institutions, excluding research centers, fiscal years 1957–64*

Range	Number of contracts							
	1957	1958	1959	1960	1961	1962	1963	1964
0 to $20,000	546	528	555	525	535	494	410	402
$20,001 to $30,000	81	94	124	155	183	205	238	213
$30,001 to $40,000	38	57	75	67	88	122	118	109
$40,001 to $50,000	28	31	38	46	59	63	71	77
$50,001 to $100,000	48	58	69	75	80	99	116	130
$100,001 to $250,000	41	51	64	62	71	39	44	48
$250,001 to $500,000		2	2		7	23	25	28
Over $500,000	2	1	1	1	1	18	26	27
Total	784	822	928	931	1,024	1,063	1,048	1,034

Source: U.S. Atomic Energy Commission.

TABLE D.—*Distribution of NSF research grants by size of grants,*[1] *selected fiscal years*

[Dollar amounts in thousands]

Size of grants	1952		1956		1960		1962		1963		1964, 1st half	
	Number of grants	Amount	Number of grants	Amount	Number of grants	Amount	Number of grants	Amount	Number of grants	Amount	Number of grants	Amount
$0 to $10,000	54	$273	295	$1,806	399	$2,366	368	$2,024	380	$2,062	149	$939
$10,001 to $25,000	36	556	342	5,226	779	13,350	816	12,576	764	13,151	366	6,186
$25,001 to $50,000	6	195	54	1,719	501	17,158	779	27,172	889	31,291	429	15,203
$50,001 to $100,000	1	50	10	607	223	14,136	358	24,089	486	33,943	269	18,246
$100,001 to $150,000			2	240	36	4,274	68	8,137	102	11,891	48	5,764
$150,001 to $200,000					18	3,134	28	4,741	41	6,858	17	2,899
$200,001 to $250,000					12	2,680	21	4,506	15	3,312	9	1,960
$250,001 to $500,000			1	250	14	4,512	18	6,170	15	5,206	9	3,005
$500,001 and over					7	6,966	4	2,514	7	5,134	2	1,754
Total	97	1,074	704	9,848	1,989	68,576	2,460	91,929	2,699	112,848	1,298	55,956

[1] Data for 1952, 1956, and 1960 compiled by Grants Office; 1962 and 1963 tabulated from list of grants in respective NSF annual reports. 1st half 1964 tabulated from quarterly summaries compiled by Grants Office. Totals represent basic research grants made by the following divisions: Biological and Medical Sciences, Mathematical, Physical and Engineering Sciences, and Social Sciences. Data exclude institutional grants, graduate lab development program, and facilities. Amendments to earlier grants have been counted as new grants. (No adjustments have been made for refunds, cancellations, etc.; therefore, the data are not comparable or reconcilable with obligations shown in the budget.) Backup data by program and division are available for 1962 and succeeding years.

Source: National Science Foundation.

TABLE E.—*National Science Foundation research projects*

Year	Total amounts expended	Number of projects	Number of institutions	Average amount of support per project [1]	Average principal investigator salary supported
1955	$7,857,395	588	184	$5,000	$1,325
1956	9,655,205	734	258	6,600	1,566
1957	15,528,925	997	350	7,543	1,612
1958	20,037,705	1,133	293	8,653	2,027
1959	49,121,529	1,809	333	12,015	2,583
1960	61,917,812	1,995	362	13,640	(2)
1961	69,035,837	2,102	381	15,747	3,539
1962	96,082,540	2,572	381	19,380	4,222
1963	117,213,210	2,714	368	19,200	4,692
1964	114,987,757	3,105	409	20,458	4,460

[1] These figures are not the result of dividing total expenditures by the number of projects. Allowance has been made for varying project duration in arriving at average amount of support per project.
[2] No data.

Source: National Science Foundation Annual Reports.

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DEFINITIONS

[US]C 502. SEC. 3. As used in this Act, the term—

(1) "State government" means any of the several States of the United States, the District of Columbia, the Commonwealth of Puerto Rico, any territory or possession of the United States, any agency or instrumentality of a State, and any multi-State, regional, or interstate entity which has governmental functions;

(2) "local government" means any unit of government within a State, a county, municipality, city, town, township, local public authority, special district, intrastate district, council of governments, sponsor group representative organization, other interstate government entity, or any other instrumentality of a local government;

(3) "other recipient" means any person or recipient other than a State or local government who is authorized to receive Federal assistance or procurement contracts and includes any charitable or educational institution;

(4) "executive agency" means any executive department as defined in section 101 of title 5, United States Code, a military department as defined in section 102 of title 5, United States Code, an independent establishment as defined in section 104 of title 5, United States Code (except that it shall not include the General Accounting Office), a wholly owned Government corporation; and

(5) "grant or cooperative agreement" does not include any agreement under which only direct Federal cash assistance to individuals, a subsidy, a loan, a loan guarantee, or insurance is provided.

USE OF CONTRACTS

[U]SC 503. SEC. 4. Each executive agency shall use a type of procurement contract as the legal instrument reflecting a relationship between the Federal Government and a State or local government or other recipient—

(1) whenever the principal purpose of the instrument is the acquisition, by purchase, lease, or barter, of property or services for the direct benefit or use of the Federal Government; or

(2) whenever an executive agency determines in a specific instance that the use of a type of procurement contract is appropriate.

USE OF GRANT AGREEMENTS

[U]SC 504. SEC. 5. Each executive agency shall use a type of grant agreement as the legal instrument reflecting a relationship between the Federal Government and a State or local government or other recipient whenever—

fers. (1) the principal purpose of the relationship is the transfer of money, property, services, or anything of value to the State or local government or other recipient in order to accomplish a public purpose of support or stimulation authorized by Federal statute, rather than acquisition, by purchase, lease, or barter, of property or services for the direct benefit or use of the Federal Government; and

(2) no substantial involvement is anticipated between the executive agency, acting for the Federal Government, and the State or local government or other recipient during performance of the contemplated activity.

USE OF COOPERATIVE AGREEMENTS

SEC. 6. Each executive agency shall use a type of cooperative agreeent as the legal instrument reflecting a relationship between the Fedal Government and a State or local government or other recipient ıenever— 41 USC 505.

(1) the principal purpose of the relationship is the transfer of money, property, services, or anything of value to the State or local government or other recipient to accomplish a public purpose of support or stimulation authorized by Federal statute, rather than acquisition, by purchase, lease, or barter, of property or services for the direct benefit or use of the Federal Government; and Transfers.

(2) substantial involvement is anticipated between the executive agency, acting for the Federal Government, and the State or local government or other recipient during performance of the contemplated activity.

AUTHORIZATIONS

SEC. 7. (a) Notwithstanding any other provision of law, each execue agency authorized by law to enter into contracts, grant or cooperae agreements, or similar arrangements is authorized and directed to :er into and use types of contracts, grant agreements, or cooperative :eements as required by this Act. Contracts, grant or cooperative agreements. 41 USC 506.

(b) The authority to make contracts, grants, and cooperative agreents for the conduct of basic or applied scientific research at nonofit institutions of higher education, or at nonprofit organizations ose primary purpose is the conduct of scientific research shall lude discretionary authority, when it is deemed by the head of the cutive agency to be in furtherance of the objectives of the agency, vest in such institutions or organizations, without further obligan to the Government, or on such other terms and conditions as med appropriate, title to equipment or other tangible personal perty purchased with such funds. Scientific research.

STUDY OF FEDERAL ASSISTANCE PROGRAMS

SEC. 8. The Director of the Office of Management and Budget, in peration with the executive agencies, shall undertake a study to elop a better understanding of alternative means of implementing leral assistance programs, and to determine the feasibility of develng a comprehensive system of guidance for Federal assistance grams. Such study shall include a thorough consideration of the lings and recommendations of the Commission on Government curement relating to the feasibility of developing such a system. Director shall consult with and to the extent practicable, involve resentatives of the executive agencies, the Congress, the General ounting Office, and State and local governments, other recipients other interested members of the public. The result of the study ll be reported to the Committee on Government Operations of the ıse of Representatives and the Committee on Governmental Affairs he Senate at the earliest practicable date, but in no event later than years after the date of enactment of this Act. The report on the ly shall include (1) detailed descriptions of the alternative means nplementing Federal assistance programs and of the circumstances vhich the use of each appears to be most desirable, (2) detailed

41 USC 507.

Contents.

Consultation.

Report to congressional committees.

descriptions of the basic characteristics and an outline of such comprehensive system of guidance for Federal assistance programs, the development of which may be determined feasible, and (3) recommendations concerning arrangements to proceed with the full development of such comprehensive system of guidance and for such administrative or statutory changes, including changes in the provisions of sections 3 through 7 of this Act, as may be deemed appropriate on the basis of the findings of the study.

GUIDELINES

508. SEC. 9. The Director of the Office of Management and Budget is authorized to issue supplementary interpretative guidelines to promote consistent and efficient use of contract, grants agreement, and cooperative agreements as defined in this Act.

REPEALS AND SAVINGS PROVISIONS

effective SEC. 10. (a) The Act entitled "An Act to authorize the expenditure of funds through grants for support of scientific research, and for other purposes", approved September 6, 1958 (72 Stat. 1793; 42 U.S.C. 1891 and 1892), is repealed, effective one year after the date of enactment of this Act.

501 note. (b) Nothing in this Act shall be construed to render void or voidable any existing contract, grant, cooperative agreement, or other contract, grant, or cooperative agreement entered into up to one year after the date of enactment of this Act.

509. (c) Nothing in this Act shall require the establishment of a single relationship between the Federal Government and a State or local government or other recipient on a jointly funded project, involving funds from more than one program or appropriation where different relationships would otherwise be appropriate for different components of the project.

(d) The Director of the Office of Management and Budget may
ns. except individual transactions or programs of any executive agency
01 note. from the application of the provisions of this Act. This authority shall
n date. expire one year after receipt by the Congress of the study provided for in section 8 of this Act.

Approved February 3, 1978.

LEGISLATIVE HISTORY:

HOUSE REPORT No. 95-481 (Comm. on Government Operations).
SENATE REPORT No. 95-449 accompanying S. 431 (Comm. on Governmental Affairs).
CONGRESSIONAL RECORD:
Vol. 123 (1977): Sept. 27, considered and passed House.
Oct. 1, considered and passed Senate, amended, in lieu of S. 431.
Vol. 124 (1978): Jan. 19, House agreed to Senate amendment.

Public Law 95-224
95th Congress

An Act

To distinguish Federal grant and cooperative agreement relationships from Federal procurement relationships, and for other purposes.

Feb. 3, 1978
[H.R. 7691]

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act be cited as the "Federal Grant and Cooperative Agreement Act of 1977".

Federal Grant and Cooperative Agreement Act of 1977.
41 USC 501 note.

FINDINGS AND PURPOSE

SEC. 2. (a) The Congress finds that— 41 USC 501.

(1) there is a need to distinguish Federal assistance relationships from Federal procurement relationships and thereby to standardize usage and clarify the meaning of the legal instruments which reflect such relationships;

(2) uncertainty as to the meaning of such terms as "contract", "grant", and "cooperative agreement" and the relationships they reflect causes operational inconsistencies, confusion, inefficiency, and waste for recipients of awards as well as for executive agencies; and

(3) the Commission on Government Procurement has documented these findings and concluded that a reduction of the existing inconsistencies, confusion, inefficiency, and waste is feasible and necessary through legislative action.

(b) The purposes of this Act are—

(1) to characterize the relationship between the Federal Government and contractors, State and local governments, and other recipients in the acquisition of property and services and in the furnishing of assistance by the Federal Government so as to promote a better understanding of Federal spending and help eliminate unnecessary administrative requirements on recipients of Federal awards;

(2) to establish Government-wide criteria for selection of appropriate legal instruments to achieve uniformity in the use by the executive agencies of such instruments, a clear definition of the relationships they reflect, and a better understanding of the responsibilities of the parties;

(3) to promote increased discipline in the selection and use of types of contract, grant agreement, and cooperative agreements and to maximize competition in the award of contracts and encourage competition, where deemed appropriate, in the award of grants and cooperative agreements; and

(4) to require a study of the relationship between the Federal Government and grantees and other recipients in Federal assistance programs and the feasibility of developing a comprehensive system of guideline for the use of grant and cooperative agreements, and other forms of Federal assistance in carrying out such programs.