NOMINATIONS

HEARING

BEFORE THE

COMMITTEE ON HUMAN RESOURCES

UNITED STATES SENATE

NINETY-FIFTH CONGRESS

FIRST SESSION

ON

GEORGE C. PIMENTEL, OF CALIFORNIA, TO BE DEPUTY DIRECTOR;

FLOYD J. RUTHERFORD, OF CALIFORNIA, TO BE AN ASSISTANT DIRECTOR;

AND

JOHN B. SLAUGHTER, OF WASHINGTON, TO BE AN ASSISTANT DIRECTOR OF THE NATIONAL SCIENCE FOUNDATION

SEPTEMBER 27, 1977

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NOMINATION

TUESDAY, SEPTEMBER 27, 1977

U.S. SENATE,
COMMITTEE ON HUMAN RESOURCES,
Washington, D.C.

The committee met, pursuant to call, in room 4232 of the Dirksen Senate Office Building, at 10:03 a.m., Senator Harrison A. Williams, Jr. (chairman), presiding.

Present: Senators Williams and Hatch.

The CHAIRMAN. The committee will come to order. We consider today the nominations for the National Science Foundation, Mr. George C. Pimentel, to be Deputy Director; F. James Rutherford, to be Assistant Director; and John B. Slaughter, to be Assistant Director; accompanied by Richard C. Atkinson, Director of the National Science Foundation.

I have a statement of broad appreciation for your nominations to these positions which will be included in the record.

[The following were received for the record:]

OPENING STATEMENT OF SENATOR WILLIAMS

The CHAIRMAN. We are very pleased to welcome as our next nominees three distinguished scientists to take positions as Deputy Director and Assistant Director of the National Science Foundation. These gentlemen—Dr. George Pimentel, Dr. James Rutherford, and Dr. John Slaughter—will bring varied backgrounds and credentials together at that agency to assist in the management of the Government's assistance to scientific research.

Nominated to be Deputy Director, Dr. George Pimentel, a professor at the University of California at Berkeley, comes to the agency as a renowned chemist whose work in the fields of infrared spectroscopy, chemical lasers, molecular structure, and hydrogen bonding is known throughout the world. The first chemical laser was discovered in his laboratory and through the use of infrared spectroscopic methods, he and his students have identified many chemical substances never before isolated. Dr. Pimentel also has been recognized as an enthusiastic teacher and was the editor of the CHEM study project, a project supported by NSF, which changed the direction of teaching of high school chemistry.

Dr. James Rutherford is nominated to be Associate Director for Science Education. Before being nominated to this position, he was chairman of the Science Education Department at New York University. As a member and past president of the National Science Teaching Association, Dr. Rutherford has had wide experience with science

teaching at the secondary and postsecondary levels. He directed a precollege curriculum project, supported by NSF and the Office of Education in physics, and has received many awards and honors for his work, including a Ford Foundation Fellowship in 1954 and the 1970 CINE award for the motion picture, "The World of Enrico Fermi."

The third NSF nominee is Dr. John Slaughter, nominated to be the Assistant Director for Astronomical, Atmospheric, Earth and Ocean Sciences. Dr. Slaughter comes to the committee as a distinguished researcher and engineer in ocean and environmental sciences. Before coming to NSF, Dr. Slaughter was the director of the Applied Physics Laboratory at the University of Washington. As such, he has directed research and exploration activities in underwater acoustics, underwater vehicles, and physical oceanography. His previous activities included program direction in information and control systems from 1960–75 at the Naval Electronics Laboratory Center in San Diego. Dr. Slaughter has also been actively involved in the encouragement of minority students in science and engineering and has served as head of the San Diego Urban League, and with the league, he was responsible for the development of programs of financial and counseling support for black and chicano youngsters.

We are very pleased to welcome all of you here today and to welcome Dr. Atkinson who has come to introduce you. Senator Kennedy, chairman of our Subcommittee on Health and Scientific Research, was unable to join us this morning but has asked that his statement be read.

[The letter referred to follows:]

United States Senate
COMMITTEE ON HUMAN RESOURCES
WASHINGTON, D.C. 20510

September 27, 1977

Honorable Harrison A. Williams, Jr.
Chairman
Committee on Human Resources
U.S. Senate
Washington, D.C.

Dear Mr. Chairman:

Please express to the nominees my regret that I am unable to be present at this morning's hearings.

I have reviewed the materials the nominees submitted to the Committee together with their past records. It is my view that these candidates are well qualified for the positions to which they have been nominated. I have also contacted a number of scientists and representatives of institutions which will be directly affected by the policies the nominees will develop. There is enthusiastic agreement that the nominees come to the Foundation with unquestioned professional credentials and with a fresh perspective on the programs they will direct.

It is my further understanding that the nominees before the Committee this morning were selected with the full participation of the National Science Board, the Director of the Foundation, and the Director of the Office of Science and Technology Policy. This coordinated approach is an important step toward the development of a coherent federal policy for science and technology. I believe this approach will serve the best interests, not only of the nation's scientists and engineers, but of all our citizens who will be affected by the policies and programs in which the federal government plays such an important role.

As Chairman of the Subcommittee on Health and Scientific Research I look forward to working closely with the nominees throught their tenure at the Foundation.

Sincerely,

Edward M. Kennedy

The CHAIRMAN. Senator Kennedy regrets that he could not be here this morning. In his letter, Senator Kennedy says:

> It is my view that these candidates are well-qualified for the positions to which they have been nominated. I have also contacted a number of scientists and representatives of institutions which will be directly affected by the policies the nominees will develop. There is enthusiastic agreement that the nominees come to the Foundation with unquestionable professional credentials and with a fresh perspective on the programs they will direct.

So, gentlemen, shall we just go down the line, introduce yourself to the record. We are under a time constraint today. If there were any problems with your nominations, we would take all the time needed, even if we had to come back on another day. There seems to be a unanimity of agreement that we are to be well served by you in the National Science Foundation.

STATEMENTS OF NOMINEES FOR THE NATIONAL SCIENCE FOUNDATION: GEORGE C. PIMENTEL TO BE DEPUTY DIRECTOR, F. JAMES RUTHERFORD TO BE ASSISTANT DIRECTOR, AND JOHN B. SLAUGHTER TO BE ASSISTANT DIRECTOR, ACCOMPANIED BY RICHARD C. ATKINSON, DIRECTOR, NATIONAL SCIENCE FOUNDATION

Mr. ATKINSON. Mr. Chairman, let me begin here with Dr. Pimentel, Dr. Rutherford, and Dr. Slaughter.

The CHAIRMAN. We will include all relevant materials that support these nominations, and do you have anything, one by one, to say briefly?

Dr. PIMENTEL. Thank you very much, Mr. Chairman. I have a statement that describes my view of the National Science Foundation, and states how I believe my experience and qualifications permit me to serve the NSF. I hope this statement will be entered in the record, and I stand ready to answer any questions you might wish to ask me.

The CHAIRMAN. Your statement will be, we appreciate it. Thank you.

Dr. RUTHERFORD. I will not read my statement either because of the time situation. I would like to emphasize, as you judge my credentials, that you also note that I am intensely interested in setting some new directions for science education at the National Science Foundation and will work very hard to achieve some new directions and some new thrusts. Thank you, Senator.

The CHAIRMAN. And you have a statement for our record?

Dr. RUTHERFORD. We have a statement for your record. I would be delighted to answer questions.

The CHAIRMAN. Again, because of the time, though we do have questions, we will not pose them at this time. Dr. Slaughter?

Dr. SLAUGHTER. Senator, I also have a statement which I will not read, but will recommend to you for entering into the record. I look forward to the opportunity of participating in the scientific programs of the National Science Foundation. I believe that my background and interests are perfectly consistent with the position to which I have been nominated. I would stand ready to answer any questions at any time of you or members of your committee.

The CHAIRMAN. Thank you. Dr. Rutherford, Senator Javits desired to be here to introduce you, but could not be, so I will, before you have spoken, your introduction will appear in the record from Senator Javits.

Dr. RUTHERFORD. Thank you.

[The prepared statements and biographical sketches of Dr. Pimentel, Dr. Rutherford, Dr. Slaughter, and statement of Dr. Atkinson follow:]

Statement by
DR. GEORGE C. PIMENTEL
Deputy Director Designate, National Science Foundation,
at the Confirmation Hearings before the
U.S. Senate Committee on Human Resources
September 27, 1977

Mr. Chairman and Senators:

Thank you for the opportunity to introduce myself and to tell you something about my view of the National Science Foundation. My entire scientific career has been in university teaching and research. Over the years, as a practicing research scientist, I have watched the growth of the NSF and admired its remarkable contribution to the strength of the U.S. science and technology. I know scientists all over the world who join me in this admiration and who urge their own governments to emulate its enlightened support of fundamental science. If confirmed as Deputy Director, I intend to aid the Director in maintaining this strength.

Fundamental science is the seeking of new knowledge about the environment, of which we ourselves are a part. This creative pursuit is one of Mankind's ennobling activities. Nevertheless, this urge to understand what goes on about us is ultimately practical. It is born of our need for security in a threatening scene. Today, this need is greater than ever. The natural vicissitudes are compounded by unexpected side effects of the very technologies that have freed so many from toil and that have nurtured the world's burgeoning populaton. Our ability to cope with the ever changing problems we shall face in the coming decades--problems

of health, nutrition, energy and food supplies, quality of life, our psychological well-being--will be rooted in our understanding of ourselves and the environment. The National Science Foundation is dedicated to that end and I will be gratified if I can contribute to its effectiveness.

My scientific experience is, perhaps, more varied than that of many scientists in this age of specialization. My fundamental interests, which relate to the nature of the chemical bond, have led to work at the interface between chemistry and physics. I have engaged in some research activity in thermodynamics, some in nuclear physics, some in spectroscopy. One of the NASA instruments that flew past Mars on the 1969 Mariner spacecraft 6 and 7 was designed and built in my laboratory. Thus, I have some familiarity with fundamental research in chemistry, physics, and astronomy. Further, my teaching has been at the introductory levels; I have participated in chemistry curriculum development at the secondary school level. I have had administrative experience in one of the largest of our universities, and service in consultative roles to various government agencies. I have been a member of the Committee on Science and Public Policy of the National Academy of Sciences.

I hope that this background will prove to be useful to the NSF. I regard this proposed appointment as an opportunity to serve our society and humankind. If confirmed, I will do the best I can to serve them well.

Biographical Sketch

GEORGE CLAUDE PIMENTEL

Professor George C. Pimentel is widely known for his scientific contributions in the fields of infrared spectroscopy, chemical lasers, molecular structure, free radicals, and hydrogen bonding. He was a pioneer in the diagnostic use of infrared spectroscopy, both for qualitative and quantitative analysis. Most of his 175 published research articles pertain to the development of new infrared spectroscopic techniques or to the exploitation of these techniques in the identification of chemical substances. With Dr. K. C. Herr, coinvestigator on the Mariner 1969 infrared spectrometer instrument, he pioneered rapid-scan infrared spectroscopy on the microsecond time scale. The low temperature technique called matrix isolation was developed in his laboratory for the infrared study of very reactive substances at cryogenic temperatures. Since the first chemical laser was discovered in his laboratory, over 30 different reactions have been shown to produce laser emission. With his students, he has identified by infrared spectroscopic methods many chemical substances not detected earlier by any other technique, including two inert-gas compounds and several free radicals.

Professor Pimentel is an enthusiastic teacher and lectured in Freshman Chemistry at Berkeley for the last six years. He is coauthor of seven books, four of which are textbooks, and three of which concern areas of his research. He has long been interested in the quality of teaching in secondary schools and served as Editor of the CHEM Study Project. This project, sponsored by the National Science Foundation, was devoted to the development of a new high school chemistry textbook. The text, CHEMISTRY--AN EXPERIMENTAL SCIENCE, was published in 1963. It is now in use in high schools in every state (more than 950,000 copies have been sold), and it has been translated into thirteen languages, including Russian. Professor Pimentel collaborated in the production of several of the CHEM Study educational films and also on the film "Wondering About Things" which concerns the impact of science on the quality of life.

In 1968, Dr. Pimentel received the Campus Teaching Award at the University of California. This award is granted to five professors each year by a student committee on the basis of student nomination and evaluations. His name was listed in the 1970 edition of "Outstanding Educators of America." He received the American Chemical Society California Section Award in 1957 and the A.C.S. Precision Scientific Award in 1959. He was elected to membership in the National Academy of Sciences in 1966, and he was elected a Fellow of the American Academy of Arts and Sciences in 1968. He is a member of the American Chemical Society, the American Physical Society, and the Optical Society of America. In

1971, he received the Manufacturing Chemists Association College Chemistry Teacher Award, in 1972, the Dickenson College Priestley Memorial Award, and in 1974, the Spectroscopy Society of Pittsburgh Award. He was awarded a Guggenheim Fellowship in 1955. He was selected as a participant in the 1973-4 US/Japan Eminent Scientist Exchange Program and an Alexander von Humboldt Senior Scientist Awardee in 1974. He delivered the 1975 Bourke Lectures sponsored by the British Faraday Society and the 1975 Faculty Research Lecture at the University of California, Berkeley.

A native of Rolinda, California, George Pimentel received the A.B. degree from the University of California at Los Angeles in 1943. Following a year on the Manhattan Project at U.C. Berkeley, and more than two years in the U.S. Navy, he returned to Berkeley and completed his graduate work under the supervision of Professor Kenneth S. Pitzer. Upon receipt of the Ph.D. in 1949, Dr. Pimentel was appointed a member of the faculty at the University of California and ten years later attained the rank of Full Professor. From 1966 to 1968 he served as Chairman of the Chemistry Department at Berkeley. He served as a member of the Lunar and Planetary Missions Board, advisory to NASA, from 1967 to 1970. Dr. Pimentel is an active squash player and for the years 1968, 1969, and 1970, he and two Chemistry Department graduate students have won the U.C. intramural team championship.

December, 1975

Publications List

George C. Pimentel

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STATEMENT OF

DR. F. JAMES RUTHERFORD

NOMINEE FOR ASSISTANT DIRECTOR FOR SCIENCE EDUCATION

NATIONAL SCIENCE FOUNDATION

BEFORE THE

COMMITTEE ON HUMAN RESOURCES

UNITED STATES SENATE

SEPTEMBER 27, 1977

MR. CHAIRMAN:

IT IS A PRIVILEGE TO APPEAR BEFORE YOU TO PRESENT A STATEMENT OF MY VIEWS AND TO ANSWER ANY QUESTIONS YOU MAY HAVE REGARDING MY PROFESSIONAL QUALIFICATIONS, PERSONAL COMMITMENT AND GENERAL SUITABILITY.

AS A FORMER HIGH SCHOOL SCIENCE TEACHER AND UNIVERSITY PROFESSOR OF SCIENCE EDUCATION, I AM WELL AWARE OF THE ENORMOUS CONTRIBUTION THE NATIONAL SCIENCE FOUNDATION'S VARIOUS EDUCATION PROGRAMS HAVE MADE TO THE IMPROVEMENT OF SCIENCE INSTRUCTION THROUGHOUT THE NATION. DURING THE FIRST TWO OR THREE YEARS OF THIS DECADE, THERE WAS A SHARP DECLINE IN FUNDING FOR SOME OF THE EDUCATIONAL PROGRAM ACTIVITIES THAT HELPED TO STRENGTHEN THE SCIENTIFIC ENTERPRISE IN THE 1960's. WHILE THE DECLINE WAS ARRESTED, IT HAS NOT BEEN REVERSED. I MENTION

THESE FACTS, NOT BECAUSE I INTEND TO PRESS FOR AN ACROSS-THE-BOARD REINSTATEMENT OF PAST PROGRAMS AND PRACTICES, BUT BECAUSE I EXPECT TO CONCENTRATE ON SETTING NEW DIRECTIONS IN SCIENCE EDUCATION. I LOOK FORWARD TO THE OPPORTUNITY AT THE APPROPRIATE TIME OF PRESENTING TO YOU A DETAILED PLAN FOR SUCH DIRECTIONS. FOR THIS MOMENT, LET ME DISCUSS BRIEFLY TWO GOALS TOWARD WHICH IN MY JUDGMENT WE NEED MORE PROGRESS IN SCIENCE EDUCATION.

THE FIREST OF THESE IS THE ACHIEVEMENT OF A BROAD BASE OF PARTICIPATION IN SCIENCE. SCIENCE IS, AFTER ALL, LARGELY A PUBLICLY SUPPORTED ENTERPRISE, AND IN A REAL SENSE, ALL CITIZENS ARE ITS PATRONS. THIS MEANS THAT WE CANNOT TOLERATE A SITUATION IN WHICH BOTH BECOMING A SCIENTIST AND SHARING IN THE UNDERSTANDING AND USE OF SCIENTIFIC KNOWLEDGE ARE UNNECESSARILY CONFINED. WE NEED, AS SCIENCE EDUCATORS, TO ATTRACT TO SCIENCE CAREERS PROPERLY REPRESENTIVE PROPORTIONS OF THE ETHNIC MINORITIES, THE URBAN AND RURAL POOR, WOMEN AND THE PHYSICALLY HANDICAPPED. TO DO SO WILL REQUIRE A SIMULTANEOUS AND IMAGINATIVE ATTACK ON THE PROBLEM AT ALL EDUCATIONAL LEVELS, PRESCHOOL THROUGH POST

GRADUATE. IN COOPERATION WITH THE OTHER DIRECTORATES IN THE FOUNDATION, I WOULD BE PREPARED TO MOUNT SUCH AN ATTACK. I ALSO BELIEVE THAT WE MUST CONCENTRATE SPECIAL EFFORTS ON IMPROVING SCIENCE INSTRUCTION FOR EARLY ADOLESCENTS. AS CHILDREN PASS THROUGH THE INTERMEDIATE AND JUNIOR HIGH SCHOOL YEARS, THEY APPEAR TO MAKE NEARLY IRREVERSIBLE DECISIONS ABOUT THEMSELVES AS PERSONS AND ABOUT THEIR PLACE IN THE WORLD OF WORK. IT IS PRECISELY AT THAT CRUCIAL LEVEL THAT OUR EFFORTS IN SCIENCE MUST BE STRENGTHENED.

BUT PARTICIPATION IN SCIENCE IS MORE THAN JUST CAREER INVOLVEMENT. IT IS ALSO A MATTER OF SHARING SCIENTIFIC KNOWLEDGE AND SCIENTIFIC THINKING WITH ALL PERSONS, NOT JUST WITH THOSE WHO ARE ALSO SCIENTISTS, NOT JUST WITH THOSE WHO GO TO COLLEGE, AND SURELY NOT JUST WITH THOSE WHO ARE IN SCHOOL AT ANY ONE TIME. HIGH QUALITY SCIENCE INSTRUCTION OUGHT TO BE AVAILABLE TO ANY PERSON WHO FEELS THAT SCIENCE CAN ENRICH THE QUALITY OF HIS LIFE BY IMPROVING HIS UNDERSTANDING OF THE NATURAL AND MAN-MADE WORLDS OR BY STRENGTHENING HIS REASONING SKILLS.

FURTHERMORE, A FIRST-RATE SCIENCE EDUCATION IS NEEDED BY ALL OF US COLLECTIVELY, BECAUSE AS CITIZENS IN A DEMOCRATIC SOCIETY WE ARE CALLED ON MORE AND MORE OFTEN TO PARTICIPATE IN MAKING DECISIONS ON SOCIAL ISSUES IN WHICH SCIENCE AND TECHNOLOGY ARE DEEPLY INVOLVED. AS CITIZEN-PATRONS OF SCIENCE, WE HAVE THE ULTIMATE RESPONSIBILITY FOR ASSESSING BOTH WHAT SCIENCE IS DOING AND HOW IT IS DOING IT. TO BRING THIS ABOUT WILL DEMAND THAT SCIENCE EDUCATION FOR THE FUTURE SCIENTIST AS WELL AS THE NON-SCIENTIST COME TO INCLUDE CONSIDERATION OF HUMAN VALUES AND SCIENCE-RELATED SOCIAL ISSUES.

THE OTHER GOAL WHICH I WANT TO ADDRESS LIES IN THE REALM OF RESEARCH AND DEVELOPMENT. THE SCIENCE EDUCATION COMMUNITY STILL OPERATES PRIMARILY FROM A BASIS OF INTUITION AND INDIVIDUAL EXPERIENCE. IN MY OPINION, TOO LITTLE OF OUR INTELLECTUAL AND MATERIAL EFFORT HAS GONE INTO GAINING A PENETRATING SCIENTIFIC UNDERSTANDING OF THE NATURE OF SCIENCE LEARNING, TOO LITTLE INTO THE SYSTEMATIC DEVELOPMENT OF A KNOWLEDGE-BASED CONCEPTUAL STRUCTURE FOR GUIDING REFORM IN SCIENCE EDUCATION. AS HEAD OF THE NATIONAL SCIENCE FOUNDATION EDUCATION DIRECTORATE, I WOULD TRY TO SPARK A NATIONAL, SUSTAINED EFFORT TO

IDENTIFY KEY RESEARCH QUESTIONS, BOTH BASIC AND APPLIED, TO SELECTIVELY SUPPORT ESPECIALLY FRUITFUL LINES OF RESEARCH, TO ENGAGE OUTSTANDING SCIENTISTS AND EDUCATORS IN THE RESEARCH, AND TO DESIGN A SYSTEM FOR CODIFYING AND DISSEMINATING THE ACCUMULATING RESULTS. THE FOUNDATION'S RESEARCH DIRECTORATES, OF COURSE, HAVE AN EXTRAORDINARY RECORD AT DOING JUST THAT, AND SO I WOULD EXPECT TO LOOK TO THEM FOR GUIDANCE AND COOPERATION.

IN SUMMARY, I BELIEVE THAT THE EDUCATION DIRECTORATE CAN AND SHOULD BE RESPONSIBLE FOR STIMULATING BROAD PARTICIPATION IN SCIENCE AND FOR THE BUILDING OF A USEFUL UNDERSTANDING OF SCIENCE LEARNING THROUGH RESEARCH AND DEVLOPMENT. I WOULD BE DELIGHTED TO LEAD SUCH AN EFFORT.

Dr. F. James Rutherford

Dr. F. James Rutherford has been Professor and Chairman of the Department of Science Education at New York University since 1971. In that position he was responsible for a complete reorganization of the science education doctoral-and master-level programs and for the development of new courses in the social, organizational, and human aspects of science. He also instituted and became Director of Project City Science. This project, funded by the National Science Foundation, began in 1974 with a long-term goal of improving science teaching in the junior high schools.

From 1964 to 1971, he was Assistant and Associate Professor of Education at the Harvard Graduate School of Education. He was also Executive Director of the Project Physics Course, a curriculum project which resulted in the production of a widely acclaimed introductory physics course. This course because of its humanistic and historical approach proved of interest to a much broader spectrum of students than the traditional physics courses.

From 1949 to 1964 he was a science teacher, head of a science department, science consultant, and director of a science-humanities project in various California high schools.

Dr. Rutherford was born in Stockton, California, on July 11, 1924. He attended California public schools and, after service in the U.S. Navy during World War II, completed his baccalaureate studies in biochemistry at the University of California, Berkeley, in 1947. He received an M.A. from Stanford University in 1949 and a doctorate in science eudcation from Harvard University in 1962.

Dr. Rutherford has authored and co-authored various papers, books, and articles dealing with science education.

Dr. Rutherford is a member of the American Association for the Advancement of Science, American Association of Physics Teachers, Association for the Education of Teachers of Science, and the National Association for Research in Science Teaching.

He has been the recipient of a number of honors and fellowships, including a Ford Foundation Fellowship in 1954 and the 1970 CINE award for the motion picture "The World of Enrico Fermi", which is used in the Project Physics Course. Dr. Rutherford developed the idea, collaborated on the script, and was co-producer. He also received the Distinguished Service Award of the American Association of Physics Teachers in 1971 and was President of the National Science Teachers Association in 1974-1975.

Dr. Rutherford was married in 1945 and has four children.

CURRICULUM VITAE

F. James Rutherford
3 Washington Square Village
New York, New York 10012

Born: July 11, 1924 (Stockton, California)
Married: 4 children

Education

University of California, Berkeley, A.B., 1947
Stanford University, M.A., 1949
Harvard University, Ed.D., 1962

Present Position

Professor of Science Education and Head of the Division of Education, New York University

Past Positions

1943-46	Radar and CTC Officer, U.S. Navy, Pacific
1947-48	Research Associate, National Oil Products, Inc.
1949-51	Science teacher, South San Francisco High School
1951-54	Science teacher and Head of Science Department,
1956-59	Capuchino High School, San Bruno, California
1961-64	Science consultant, and director of the Science-Humanities Project, San Mateo Union High School District (7 high schools)
1964-71	Assistant to Associate Professor of Education, Harvard Graduate School of Education, and Co-Director, Harvard Project Physics
1971-77	Professor of Science Education and Chairman of the Department of Science Education

Selected Professional Activities

Consultant, School Science Laboratory Planning	1949-1951
Director, Carnegie-Harvard Physics Curriculum Project	1962-1964
Research Associate, Harvard Graduate School of Education	1962-1964
Science Representative, California Council on Instruction	1962-1964
Chairman, AETS Committee on Doctoral Standard in Science Education	1964-1966
Member, AAAS Cooperative Committee on the Teaching of Science and Mathematics	1966-1971

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Field Reader for the United States Office of Education	1966-present
Publications Committee, National Science Teachers Association	1967-1969
Panel on the Preparation of Physics Teachers, Commission on College Physics	1967-1970
Executive Committee, National Science Teachers Association	1967-1969
Chairman, Commission on Professional Practices and Standards in Science Teaching	1968-present
Chairman, AAAS-CC Committee on Evaluation of Science Curricula	1968-1971
Consultant, Science Education Division, UNESCO	1968-present
Visiting Lecturer, University of Rome	1969-1970
Member, CCP-AAPT Joint Committee on Physics in the Two-Year College	1969-1972
Chairman, Advisory Committee, Research on NSF Comprehensive Project in Teacher Education	1971-present
Consultant, National Science Foundation	1973-1975
Consultant, National Institute of Education	1973-present
Council of Scientific Society Presidents	1973-1975
Advisory Board, Human Sciences Program, BSCS	1975-present
Education Advisory Committee, New York Academy of Sciences	1975-present
Consultant on Physics Education, Arab League Education, Science and Culture Organization, Cairo	1976
Advisory Board, Office of Opportunities in Science, AAAS	1976-present
Visiting Committee, Education Programs, Yale University	1976
Consultant on utilization of new Science Center, Singapore	1976
Consultant, Conference on Science Education in American Indian Post-Secondary Institutions, Denver	1977

Professional Memberships and Honors

American Association for the Advancement of Science*
American Association of Physics Teachers*
Association for the Education of Teachers of Science*
History of Science Society
National Science Supervisors Association

National Association for Research in Science Teaching*
National Science Teachers Association*
Cine Award (1970) for Excellence in Film Making
(Science, Educational)
Distinguished Service Award, American Association of
Physics Teachers (1971)
Distinguished Service Citation, National Science
Teachers Association (1974)

*Offices held

Publications and Papers

"Philosophy of Science Revisited," Philosophy of Science, 27: 183-186.
"American University Policies and Practice in Preparing Leaders in Science Education - A Research Report," Journal of Research in Science Teaching, 1: 104-118 (1963).
"The Role of Inquiry in Science Teaching, "Journal of Research in Science Teaching, 2:80-84 (1964).
"Flexibility and Variety in Physics," The Physics Teacher, 5:215-221 (1967).
"Evaluation Activities of Harvard Project Physics," Science Education News (American Association for the Advancement of Science) 6-67.
"The Nature of Integrated Science Teaching" and two additional chapters (with Marjorie Gardner) in New Trends in Integrated Science Teaching, Paris: UNESCO, 1970.
Editor (with Gerald Holton and Fletcher G. Watson) of all the books, programmed instruction booklets, teacher guides, film loops and films of the Project Physics course and major author of many of them.
"Preparing Teachers for Curriculum Reform," Science Education, 55(4): 555-568 (1971).
"Changing the Attitudes of Curriculum Developers Toward Curriculum Evaluation and Research," Curriculum Theory Network, 7:15-20 (1971).
"A Humanistic Approach to Science Teaching," NASSP Bulletin, 56:53-62 (1972).
"Integrated Science Teaching," Congress on the Integration of Science Teaching, Varne, Bulgaria, 1968.
"The Researcher--Practioner Gap in Education," Annual Meeting, American Education Research Association, 1973.
"Science Teachers and Social Responsibility," Annual Meeting, Association for Science Education, Durham, England, 1975.
"The Four-Fold Failure of Science Education: Goals for the Next Decade," Presidential Address, NSTA Annual Convention, 1975.
"Preparation for the Teaching of Science-Related Social Issues," AAAS, 1976.

"The Role of Professional Associations in Improving Science Teaching: Limitations and Opportunities," Keynote Address, Annual Meeting, Australian Science Teachers Association, Adelaide, 1976.

"A Comprehensive Model for Improving Science Teaching," Macquarie University, Sydney, Australia, 1976.

"Why Research in Science Education Has Not Affected Science Teaching, and What To Do About It," New York Academy of Sciences, 1977.

"Freedom and Responsibility in Science Teaching at the Precollege Level," Annual Meeting, AAAS, 1977.

STATEMENT OF
DR. JOHN B. SLAUGHTER
NOMINEE FOR ASSISTANT DIRECTOR
ASTRONOMICAL, ATMOSPHERIC, EARTH AND OCEAN SCIENCES
THE NATIONAL SCIENCE FOUNDATION

BEFORE THE COMMITTEE ON HUMAN RESOURCES
UNITED STATES SENATE

SEPTEMBER 27, 1977

Mr. Chairman:

I am extremely honored to appear before you today as President Carter's nominee to be Assistant Director for Astronomical, Atmospheric, Earth and Ocean Sciences (AAEO) of the National Science Foundation (NSF). I am pleased to have this opportunity to express both my comprehension of the responsibilities and the challenges of the position, as well as my objectives for the continued improvement of the Directorate and the Foundation if I am confirmed.

I am very conscious of the responsibility of the NSF to strengthen U. S. science through the support of basic and applied research and a broad effort in science education. I am also mindful of the roles of the Congress and the Executive Branch in the development and enhancement of the Nation's scientific resources and potential. Although my direct involvement has just commenced, I have become exceedingly impressed by the high degree of commitment, knowledge, and experience demonstrated by representatives of these various governmental entities who are charged with the responsibility for guiding and insuring the

continued vitality and effectiveness of our country's research efforts.

The AAEO Directorate of the NSF is an important focus for basic research within the Foundation. It is also one which will require creative leadership during this period of international interest and activity in those disciplines related to the environmental sciences. At no time in the past has there been a greater need for knowledge and understanding of the dynamic processes underlying the interactions between the cosmic, atmospheric, oceanographic and geologic regions of our universe. Clearly the disciplines involved in the studies of the phenomenology associated with these regions are strongly interrelated.

It will be my goal to identify and foster those opportunities for synergistic relationships which will improve our overall effectiveness and potential for increased understanding of these processes. Research in areas such as climate dynamics, earthquake modeling, chlorofluorocarbon concentration in the atmosphere, and air-sea-ice interactions, to mention a few, requires novel multidisciplinary approaches which differ from the more traditional methods of supporting and conducting scientific research. This is but one of the key issues which must be addressed by the leadership of the Foundation.

I am also mindful of the contribution I may be able to make in increasing the involvement of minorities, women and the disadvantaged in the field of science. The under-representation of these groups is a matter of grave concern to all of us. I will work very closely with the

Director, Dr. Atkinson, who has already expressed his commitment to apply the resources of the Foundation in ways that can meaningfully address this problem. I look forward to assisting him and the other senior managers of the Foundation on this important matter.

I look forward to the many challenges and the opportunities that exist in the fields of science management and policy-making. I believe that the charter of the Foundation is a vital and serious matter that requires dedicated efforts. I am fully committed to the task of helping NSF fulfill the mandate which the Congress has entrusted in its care.

Thank you, Mr. Chairman.

1. NAME OF CANDIDATE SLAUGHTER, JOHN BROOKS
Last, First, Middle

PRESENT OCCUPATION Director, Applied Physics Laboratory, University of Washington
Position, Organization

BUSINESS ADDRESS 1013 N. E. 40th Street
Seattle, Washington Zip Code 98105

HOME ADDRESS 3 Lummi Key
Bellevue, Washington Zip Code 98006

BIRTHDATE March 16, 1934 IEEE MEMBERSHIP GRADE Senior Member

2. EDUCATION

Educational Institution	Location	Degree	Year
Kansas State University	Manhattan	B.S.E.E.	1956
University of California Los Angeles	Los Angeles	M.S.E.	1961
University of California San Diego	San Diego	Ph.D.	1971

3. PROPOSED CITATION (not more than thirty words)

For contributions to the design of digital, sampled-data control systems and for his efforts to enhance opportunities for minorities to enter and contribute to the field of engineering.

5. PROFESSIONAL HISTORY PRESENT POSITION FIRST LIMIT COPY TO THIS PAGE

From (year) to (year) Name of Company — Position Held and Responsibilities

1975 - Date Applied Physics Laboratory, University of Washington

As Director of the Laboratory, Dr. Slaughter is responsible for the overall direction and management of a comprehensive research and development program in ocean and environmental sciences and engineering. The Laboratory is a recognized leader in underwater acoustics, underwater vehicles, and physical oceanography. Under his direction it has grown from a staff of 180 to 240 persons and has increased its funding from $5M to $7M annually. New programs in energy resource conservation and development, geophysics, environmental acoustics, and bioengineering have been initiated under his leadership. In addition to his responsibilities as Director of the Laboratory, he is also a full professor on the faculty of the Department of Electrical Engineering.

1960 - 1975 Naval Electronics Laboratory Center, San Diego

Dr. Slaughter progressed through the organization to a position of Department Head of the Information Systems Department in which he was responsible for the management of a 200-person staff engaged in the design and development of Navy command control and communication systems. Activities in the Department included computer systems technology, display systems technology, control systems technology, information transfer and switching, and human factors. Under his direction a major new emphasis in biomedical engineering was launched. Dr. Slaughter was recognized for his innovative and human-oriented managerial style which created a strong sense of purpose and achievement throughout the organization. While serving as a Division Head of the Advanced Control System Division, he led a highly successful team effort which was directed toward the development of closed-loop digital control system techniques for Navy surveillance and weapon systems. His organization did the original exploratory development work that led to the initial applications of digital computers as controllers for search and tracking radars and for gun mounts and missile launchers.

1956 - 1960 General Dynamics Convair, San Diego

After graduation from undergraduate school he joined Convair and worked on the development of missile flight instrumentation and telemetry equipment. Later he was responsible for post flight simulation of the early Atlas ICBM flights.

6. PROFESSIONAL AWARDS, PROFESSIONAL ENGINEER'S LICENSE, OTHER PROFESSIONAL SOCIETY AFFILIATIONS AND GRADES OF MEMBERSHIP. LIMIT COPY TO SPACE PROVIDED.

ETA KAPPA NU, Honorary Electrical Engineering Society, 1955
SIGMA TAU, Honorary Engineering Society, 1955
Institute of Electrical and Electronic Engineers (IEEE), Senior Member
IEEE Computer Society
American Association for the Advancement of Science (AAAS)
Scientist of the Year (NELC), 1965
IEEE Region Six Community Service Award, 1972
Who's Who Among Black Americans, 1975
American Men and Women of Science, 1976
Who's Who in Engineering, 1977
Editor, International Journal of Computers and Electrical Engineering, 1973 -
Professional Engineer (Electrical Engineering), No. 16088, State of Washington

During the period 1962-1965, at the Naval Electronics Laboratory Center, John Slaughter established and mobilized a group of engineers and technicians which soon became the Navy's most qualified in-house automatic control systems experts. The prime contribution of this group was to design and implement a closed-loop digital control system using an electro-hydraulic shipboard surface-to-air missile launcher as a plant and a general purpose shipboard digital computer as the controller. Slaughter recognized the opportunity, proposed the development to the Navy, sold the concept in spite of objections from many who believed it could not work, and managed the effort to a successful completion. He was the principal technical investigator as well as a supervisor of the total project. The work consisted of (1) the extension of existing theory of digital, sampled-data control to account for quantization effects, noise, and conversion errors; (2) hybrid simulation, (3) design of system hardware and software, and (4) conduct of the tests to demonstrate feasibility.

Explain why this contribution is significant

In 1962 a body of theory for sampled-data control was available but no applications existed except in the form of simulations. Computers were expensive and not appropriate for real-time applications. No one else had used a large general-purpose computer in this way and many experts felt that low sampling rates would lead to instabilities, large errors and possibly even damage to massive rotating machinery. Slaughter persisted in his belief in the approach.

B. Other personal contributions are

John Slaughter has expended considerable energy in working to encourage minority youngsters to pursue careers in science and engineering and has played a strong role in urging educational institutions, industry, and government to take more aggressive steps to improve the opportunities for minorities to achieve meaningful positions in engineering. He served as President of the San Diego Urban League and in that position initiated several programs of financial and counseling support for Black and Chicano students. He has established programs at schools with large minority programs and has worked with the Deans and Electrical Engineering Department Chairmen at the six predominantly Black engineering schools of the United States. He now serves as National Chairman of the IEEE Minority Committee and as a member of the National Academy of Engineering Committee on Minorities.

C. Other evidence of outstanding technical leadership resulting from team or company-wide effort

In 1968, during the Vietnam War, the Navy reactivated the battleship USS NEW JERSEY and outfitted her for combat. Prior to deployment, it was decided that her vintage pre-WWII ballistic computer system needed replacement by a more up-to-date system. Dr. Slaughter and his control system division were assigned the task to develop and install a fully automatic digital system in less than 90 days. They were successful--the system was installed just before sailing and it was checked out and calibrated while the New Jersey steamed to Southeast Asia. The Initial Ballistics Correction System provided fast and accurate calculation and display of parameters required to aim the 16" gun batteries. Quantities such as wind speed, temperature, atmospheric pressure, powder age and impulse were processed by a mini-computer. A display system designed and developed by the group provided read-out for the gun controllers. The system was lauded by the C.O. of the NEW JERSEY and resulted in Navy Distinguished Service Awards for two members of the group who contributed most to the design and test.

8. TECHNICAL PUBLICATIONS.* List the three most important publications first, stating the engineering significance of each, followed by not more than twelve additional publications. (See item 8, page 4, of the "Guide for IEEE Fellow Grade Nominations" for method of listing publications.)

The three most important publications, and their engineering significance, are:

J. B. Slaughter, "Quantization Errors in Digital Control Systems," IEEE Transactions on Automatic Control, Vol. AC-9, No. 1, January 1964

(Provides a convenient and straightforward procedure for analyzing quantization in a digital control system and can be used to specify the precision required by a digital controller and its associated conversion equipment.)

J. B. Slaughter and A. B. Rosenstein, "Twin-T Compensation Using Root Locus Methods," AIEE Transactions - Pt II, Vol. 81, January 1963.

(Provides design techniques for the synthesis of RC Twin-T networks with specified singularities.)

J. B. Slaughter, "Interactive Displays for Tactical Command Control," Journal of Computers and Electrical Engineering, Vol. 3, No. 3, September 1976

(Contains description of state of art and future directions for interactive display technology as it relates to requirements of tactical command control systems.)

Tabulate not more than twelve additional publications and identify, where possible, their individual importance. Articles are to be grouped by the journals in which they were published.

J. B. Slaughter and D. H. Lackowski, "Digital Control of a Tactical Weapon with a Shipboard G-P Computer," Proceedings of the IEEE National Conference on Military Electronics, September 1963

(First release of information describing closed-loop digital control of major weapon.)

J. B. Slaughter, "Compensating for Dynamics in Digital Control," Control Engineering, May 1964

(Clear exposition of elements of digital controller synthesis.)

J. B. Slaughter, "The Application of Separable Programming to Optimal Control Problems with Quadratic Cost and Convex Constraints," Proc. of Fourth Hawaii International Conference on Systems Sciences, January 1971

(Provides techniques for solving an important class of nonlinear problems by piece-wise linear programming.)

J. B. Slaughter, "A Linear Programming Approach to the Controllability of Constrained Linear Systems," Proceedings of the 15th Midwest Symposium on Circuit Theory, May 1972

(Provides geometrical insight into controllability of linear systems.)

J. B. Slaughter, "Understanding the Software Problem," Proceedings of 1974 National Computer Conference, Vol. 43, May 1974

(Attacks the major problem facing the designer and buyer of large-scale computer systems.)

*IMPORTANT NOTE FOR ITEMS 8 AND 9--EVIDENCE OTHER THAN PUBLICATIONS OR PATENTS. Where major visible evidence of the technical accomplishments of the candidate is tangible form other than or in addition to publications and patents, the nominator is invited to use

AND IDENTIFY THE EXTENT OF ITS USE. LIMIT COPY TO SPACE PROVIDED.

NONE

10. MAJOR IEEE ACTIVITIES. LIMIT COPY TO SPACE PROVIDED.

Dr. Slaughter's IEEE involvement has been concerned principally with efforts in human relations and minority activities. In 1972 he received the IEEE Region VI Community Service Award for his contributions in this area. In 1976 he was named by the Chairman of the IEEE Educational Activities Board to serve as Chairman of the IEEE Committee for Professional Opportunities for Minorities. In that capacity he has concentrated on defining a more aggressive affirmative action program for the Society with the principal focus on increasing the number of minority young people being educated as engineers. Fundamental to this effort are his plans to involve other professional societies in a comprehensive program covering all engineering disciplines thereby benefiting from the financial and manpower resources synergy that can result from collective efforts.

In technical matters he has served as Publications Chairman and Session Chairman for IEEE Decision and Control and WINCON meetings.

11. NON-IEEE MAJOR COMMITTEE MEMBERSHIPS AND ACTIVITIES. LIMIT COPY TO SPACE PROVIDED.

- Served as Director and Vice-Chairman of the Board of the San Diego Transit Corporation, 1968-1975, specializing in policy matters related to transit planning and technology.
- Served as member of affiliate engineering faculty at San Diego State University, 1963-1965, and established graduate courses in discrete and optimal control systems.
- Appointed to membership on National Academy of Engineering Committee on Minorities in Engineering, 1976
- Appointed to San Diego Chamber of Commerce Energy Task Force to advise on technological approaches to energy conservation, 1974.

STATEMENT OF
DR. RICHARD C. ATKINSON
DIRECTOR, NATIONAL SCIENCE FOUNDATION
BEFORE THE
COMMITTEE ON HUMAN RESOURCES
UNITED STATES SENATE
SEPTEMBER 27, 1977

Mr. Chairman and Members of the Committee:

I am pleased and personally privileged to introduce three of the President's nominees for top management positions in the National Science Foundation. All are exceptionally qualified to serve in the leadership of the Foundation. I look forward with a keen sense of appreciation for the use of their several talents in NSF operations, and I commend them to you as eminently capable and worthy of your confidence in the management of NSF's programs.

Dr. George C. Pimentel, the nominee for Deputy Director, is internationally known both for his research in chemistry and for his contributions to the teaching of science. The first chemical laser was created in his laboratory. Since then, he has identified many chemical substances not detected earlier by any other technique. In the field of education, he served as editor of the CHEM Study Project which developed a new high school chemistry textbook. Now in use in every state, the book has been translated into 13 languages. Dr. Pimentel is a member of the National Academy of Sciences and serves on its Committee on Science and Public Policy.

Dr. F. James Rutherford, the nominee for Assistant Director for Science Education, has been a professor and chairman of the Department of Science Education at New York University since 1971. He was responsible for reorganizing the university's doctoral and master-level programs in science education and for developing new courses in the social and human aspects of science. Beginning in 1974, he headed a national project with a long-term goal of improving the teaching of science in junior high schools.

Dr. John B. Slaughter, the nominee for Assistant Director for Astronomical, Atmospheric, Earth, and Ocean Sciences, comes to the Foundation from the University of Washington where he has been a professor of electrical engineering and Director of the Applied Physics Laboratory. He managed a comprehensive program of research and development in the ocean and environmental sciences and engineering. His laboratory is a recognized leader in underwater acoustics, underwater vehicles, and physical oceanography.

As you know, Mr. Chairman, a fourth position in the top management of the Foundation, Assistant Director for Mathematical and Physical Sciences and Engineering, is also vacant. The National Science Board has made recommendations to the White House for the position. When the President makes known his choice, I will be pleased to assist in arranging an appearance of the nominee before you and other Members of the Committee.

Let me say now that I am delighted to have Drs. Pimentel, Rutherford, and Slaughter in the Foundation. They are more than welcome; they are essential to the continued effective management of NSF's research support programs. All have first-hand experience in their fields of research and top

management experience in the operation of comprehensive science research programs. They are unusually well qualified to assist in leading NSF's programs in which more than 30,000 scientists participate in the peer review process and 25,000 principal investigators and 16,000 graduate students conduct research projects supported by NSF. Competent leadership at the top of the structure is absolutely essential.

Mr. Chairman, it is generally recognized that United States science has made substantial progress in recent years. Advanced research in major fields of science today deals with the most complex phenomena, issues and questions. The Foundation appreciates the key role played by this Committee in the progress of science and anticipates a continued, mutually productive relationship in the years ahead.

This concludes my remarks, Mr. Chairman. Drs. Pimentel, Rutherford and Slaughter also have brief statements. When they have concluded, we will be pleased to answer any questions that you or other Members of the Committee may have.

INTRODUCTORY STATEMENT OF SENATOR JAVITS

Senator JAVITS. Mr. Chairman, I am pleased to introduce to the committee Dr. F. James Rutherford, President Carter's nominee to be Assistant Director for Science Education of the National Science Foundation. Although Dr. Rutherford is a native of California, we New Yorkers look upon him as a most eminent adopted son, for since 1971 he has been chairman of the Science Education Department of New York University and director of Project City Science in New York City. In this latter role, Dr. Rutherford has performed a most valuable service by demonstrating that, within the inner city, strong programs of high school science education and teaching can be developed. Cooperation among New York University, the city board of education, local schools, and teachers has made this project a great success.

Throughout a distinguished career as a science educator, Dr. Rutherford has demonstrated an unquestioned ability to integrate, both pedagogically and administratively, the sciences with arts. From 1964 to 1971, while associated with the Harvard University Graduate School of Education, he was director of the Harvard project physics course, a curricular program which generated a widely acclaimed and highly successful introductory course in physics for high school and college students. This course, which innovately stressed not only the applied aspects of physics, but its humanistic and historical sides as well, captured the imagination and interest of thousands of young students. We thank Dr. Rutherford for his part in the regeneration of student interest in scientific inquiry.

As chairman of the Department of Science Education at NYU, Dr. Rutherford was responsible for the complete reorganization of doctoral and masters-level programs, and for the development of new curricula in the social, organizational, and human aspects of science.

Dr. Rutherford's commitment to the advancement of science education and the reform of scientific curricula, and his understanding of the necessity for humanistic approaches to the sciences, make him a most appropriate nominee to direct science education programs at NSF.

The CHAIRMAN. Dr. Pimentel, our records show that you have stockholdings in a number of companies which do a substantial amount of research or produce major scientific equipment which might be involved in NSF-funded activities. Since NSF also funds research projects jointly participated in with private companies, it would seem necessary to explore your removing yourself from decisions where there could be any possible conflict.

Have you thought this one through?

Dr. PIMENTEL. Frankly, Senator, my stockholdings are embarrassingly small for a man of my age, and it never occurred to me that anyone might interpret a possibility of conflict of interest. If it were to be construed, I would be very pleased to divest myself of these minute amounts of stock, or, on the other hand, if I have not yet, agree not to participate in any decision involving any of these companies.

The CHAIRMAN. Well, the whole question has national importance, as you know, and your sensitivity to the situations that might give that appearance of conflict is important. As long as you are mindful of this, and would agree to remove yourself.

Dr. PIMENTEL. I am mindful, and I would certainly, if there were any question in my mind that there might be a problem, consult with our General Counsel and get his opinion and act in accordance with it to avoid any conflict of interest or appearance thereof.

The CHAIRMAN. I really regret that we can't have a discussion here for our committee to get to know you better. We have shown new attention to our responsibility to the National Science Foundation and, regrettably, this is one of those mornings where we can't fully explore with you your thoughts as you come to these important positions.

But the record is so abundant with descriptions of excellence that you bring to these positions, I think it is not necessary. It would be illuminating for us, but not necessary for us to do it, however.

Dr. PIMENTEL. Senator, I would note that my colleagues here and I would be pleased at any time in the future, if we are confirmed, to come and visit with you.

The CHAIRMAN. Well, that is most appreciated—and those times will come. Thank you very, very much.

[Questions submitted for the record by the members of the committee, along with other statements received by the committee in support of this nomination, follow:]

98-146 O - 77 - 4

RESPONSES TO QUESTIONS

SUBMITTED BY

HONORABLE HARRISON A. WILLIAMS, JR.
CHAIRMAN, COMMITTEE ON HUMAN RESOURCES

TO

GEORGE C. PIMENTEL
DEPUTY DIRECTOR
NATIONAL SCIENCE FOUNDATION

October 19, 1977

1. I am impressed that the entire panel has experience and interest in the area of science education. Dr. Pimentel, I believe that you remarked in evaluation of the CHEM Study that there was a very important high school student group that your curriculum project had not assisted -- those who are not interested or inclined to study science at all. I wonder if each of you from your own particular perspectives and charge within the Agency can speak to this question -- particularly in the area of encouraging minorities to come into the basic sciences.

Answer

Most of the science curriculum projects of the early 1960's were specifically targeted toward the population of students already enrolling in high school science courses. Speaking broadly, this population was drawn mostly from the half of the student body who were academically most successful. This targeting was deliberate and in response to a specific and urgent need, to modernize and replace texts and teaching methods that were more than 20 years obsolete. Generally speaking, the curriculum materials so produced made a quantum jump improvement in science education at the high school level.

The national need in science education today is a different one, but it is perhaps even more urgent than the one recognized in the post-Sputnik period. Today, we must provide science education targeted at the "forgotten half" of our students -- those who will not be going on to college and who have not been opting in the past for the conventional high school science courses. The need is to raise the scientific literacy of the entire population, so that we can achieve a more general participation in techrological decision-making in our democratic society. It is certain that this will require development of different kinds of science education materials that should be introduced at the pre-high school level. It is fortunate that such an endeavor also provides the most effective means for improving the opportunities for minorities and women to enter scientific, engineering, and medical careers. It is before the student enters high school that basic skills must be established, motivation and interest must be ignited, and attitudes of self-confidence must be developed to permit these students to realize their full potential.

Hence, I would like to see NSF mount a powerful program directed at raising the scientific literacy of non-college bound students at the junior high school level. This would meet one of the most important problems of this technological era, to bring all of the people, including minorities, into fuller participation in the decisions that affect their lives.

2. One policy issue increasingly before the Committee has been the role of the public in making decisions about priorities and policy in research. Particularly in the biomedical research area -- with the President's Commission on Human Subjects, recent legislation to regulate the safety of DNA research and future legislative initiatives -- this issue will be a real one for the Committee. I wonder if each of you could provide me with your thoughts about the role of the public -- particularly, in determining research priorities, in involvement at the research institution level and in National policy making.

Answer

My attitudes about the crucial importance of the role of the public in making the value judgments that affect their lives are expressed in my article entitled "Science and Social Responsibility" in Berkeley -- A Challenge to Understanding, edited by A. J. Shartsis and R. D. Rosen, Berkeley, June, 1966. In this article, I contend that scientists have a special responsibility to educate the public about the matters within their expertise. Their role is to help the elected representatives of the people make informed judgments about the uses that are made of the fruits of science and technology. In turn, these informed judgments by our elected representatives must express the value priorities of the entire citizenry, whose lives are affected by these complex decisions. For effective implementation of this democratic prescription, we must strive for broader scientific literary that extends throughout our society.

3. Information regarding CIA drug experimentation on unwitting subjects as well as experiments on prisoners and other institutionalized persons raise the question of the need for basic standards in research. Do you believe that there can be standards of conduct and ethics in science -- in research and teaching -- which can be openly arrived at and agreed to by the research community? Is there a proper role for NSF in encouraging the adoption of such standards? Is there a proper role for the public?

Answer

I believe that a scientist should have at least as high standards of conduct and ethics as those of the general society. How these standards can be established among sciertists -- "openly arrived at and agreed to" -- is no more evident for this special group than it is for the general population. One of the most difficult areas in which to gain universal agreement and to induce compliance is that of ethical behavior. Scientists will be specially concerned, as well, with freedom of thought and inquiry, and these are also values held precious in our society.

These are matters that should be under constant discussion, including as broad participation as possible. I see a service that NSF can perform in providing opportunities and forums for these discussions, both among scientists and the public. However, I would be cautious to assign to NSF responsibility for encouraging adoption of or enforcing a particular set of standards of conduct.

RESPONSES TO QUESTIONS

SUBMITTED BY

HONORABLE EDWARD M. KENNEDY
CHAIRMAN, SUBCOMMITTEE ON HEALTH AND
SCIENTIFIC RESEARCH
COMMITTEE ON HUMAN RESOURCES

TO

GEORGE C. PIMENTEL
DEPUTY DIRECTOR
NATIONAL SCIENCE FOUNDATION

October 19, 1977

1. At President Carter's request the OMB recently asked Department and Agency heads to consider strengthening their commitment to basic research in the FY 1979 budget.

- How does the Foundation plan to respond to the President's initiative?

Answer

The NSF must maintain close liaison with the other Agencies to be certain that proper attention is directed toward those scientific areas where progress is likely. Such liaison will permit NSF to bridge areas not clearly within the purview of any mission-oriented Agency and to avoid duplication beyond what is optimum for healthy diversity of funding sources and modes of attack.

- Can the Foundation strengthen its commitment to basic research? If so, how?

Answer

Yes, I believe it could do so by improving the flexibility of conditions under which its support is provided to creative researchers. Most of the important discoveries are unanticipated and we must not erect barriers to the exploration of surprising new avenues that may appear. This means that the NSF must be very careful to fulfill its obligation to maintain accountability in a fashion that does not interfere or prevent achievement of the Agency mission.

If we require a researcher to prove that he has spent his research funds just the way he predicted he would two years earlier (when his proposal was written), we are essentially instructing him not to pursue unexpected developments.

Of course, the NSF is increasing its accountability demands on support recipients in direct response to pressure from Congress, reflecting the public mood. The NSF must vigorously and persuasively explain why such accountability in excess actually defeats the purpose of the support.

- In your opinion has too much emphasis been placed by NSF and others on applied research to the detriment of basic research programs?

Answer

I feel that the amount of NSF support directed toward applied research should be carefully monitored and remain only a modest portion of the total NSF activity. It belongs in NSF only because the NSF has immediate contact with a special group, those engaged at the frontiers of science. Sometimes this contact can be exploited to speed up the movement of new knowledge from the research laboratory into application to societal problems. But as quickly as the research results can be seen to be moving toward practical use, the NSF should transfer responsibility for continued R&D to the appropriate mission Agency.

2. Earlier this year this committee initiated the creation of an important new program designed to strenghten the Foundation's basic research effort. The Basic Research Stability Grant Program recognizes the need for relatively small sums of flexible funds to supplement and undergird the competitive project awards. The appropriations committees agreed. They provided the full amount authorized ($4.5 million) to begin the program. While total BRSG funds should always remain a small proportion of total research funds, the current program level would seem insufficient to meet the need.

- What level of support should be provided? Would a level equal to 5% of 10% of the project support provide an optimum balance?

Answer

In my present view, 10% of the project support directed into Basic Research Stability Grants would nct be an economic and judicious use of public funds. The amount so directed can be measured against what the institutions now receive from NSF. If it is a small amount and the BRSG support is comparable in magnitude, some stabilization is assured. If the institution receives a larger amount, a relatively smaller amount is adequate because statistically the fluctuation will not be so acute.

- Should a direct funding relationship be established between the project funds and the Basic Research Stability Grant Program? Should the two be tied together?

Answer

I don't believe so. Generally, the funds so provided tend to go into disciplinary areas where the local ability to compete for funds is not high. Thus funds tend to be diverted from proposals with high expectation of fruitful results toward the other end of the spectrum. We should measure carefully how much of this we do and try to make sure that truly meritorious research is not suffering from this diversion of funds.

3. The NSF budget for the fiscal year beginning on October 1st contains a significant increase in appropriations for scientific instrumentation.

- What is the condition of scientific instrumentation in the nation's research laboratories?

Answer

In chemistry and biology instrumentation is one of the most pressing needs. Obsolescence cannot be measured by chronological age but rather it must be considered in the light of the advances of the techniques in use. Both chemistry and biology are advancing so rapidly and becoming so sophisticated that instrumentation has not kept pace. We must provide the modern tools or our scientific effort will fall behind those of other countries (e.g., West Germany, USSR) that are providing more ample funds. In some areas, this disadvantage is being felt already.

- Will equipment continue to be a pressing need and a priority for the Foundation?

Answer

Yes. The need is an on-going one, not to be put to rest by a single "shot in the arm."

4. Research libraries reportedly are suffering from similar signs of decay. For example, a recent article in Science illustrated the great strain being placed on budgets by costly scientific journals.

- Are the problems confronting research libraries affecting the Foundation's research programs in Universities? If so, how?

Answer

In my own experience, the difficulties faced by our own science library were not yet impeding my research. However, the exponential rise that we are seeing in scientific publications makes it clear that problems will come. It becomes more and more difficult for a library to house and a researcher to access all of this new information.

-- What steps might NSF take to address the research-related needs of the nation's major libraries?

Answer

I believe that the NSF should encourage and support research on innovative means of accessing, storing, and searching scientific information. A good example is provided by the Foundation's support of ways to automate CHEM ABSTRACTS, which has led to significant strengthening of research in chemistry.

5. The number of young faculty and researchers being hired at U.S. universities has fallen rapidly during the past decade or so.

- Is this a long range problem or is it a short term problem which will correct itself in several years?

Answer

I think the problem is particularly acute at this time because of demographic trends of the past two decades. Ten years from now, the universities and government laboratories may have adjusted to a steady-state hiring policy to maintain reasonable entry-rate for young researchers. Whether such adjustments will be able to deal with the problem remains to be seen.

- What role do you feel the NSF should play in addressing this problem?

Answer

The NSF should look for programs that might bridge the ten year period called out above and then phase them out if the problem seems to be correcting itself. One possibility is to support a carefully selected number of well established and still extremely productive senior scientists in a fashion that essentially opens their position for a young-scientist appointment.

6. Some recent studies, including the State of Academic Science which NSF supported, have concluded that research scientists, both senior and junior, are wasting excessive amounts of time doing paper work, i.e., writing multiple proposals, second progress reports, etc. They report that less time can be devoted to research as the result.

- Do you believe that this is a significant problem among NSF investigators? If so, what can be done to reduce this distracting burden?

Answer

I have not been a recipient of NSF research support so all I can say is that I have heard a large amount of anecdotal evidence from colleagues indicating that this burden is increasing and it is distracting. My own experience with research support from other agencies certainly agrees -- during the last five years, paper work and accountability requirements have increased manyfold and surely detract from the opportunity to accomplish the research that is the reason for the grant.

7. How can you as Deputy Director of the Foundation further the goals of excellence in science education and/or the improved public understanding of science?

Answer

I believe that the most needed and most neglected aspect of science education is at the pre-high school level for the academically less successful half of the students in this country. I wish to encourage the preparation of curricular materials specifically directed at this group, preferably at the Junior High School grades. That will raise the scientific literacy of the entire population which is the necessary foundation for improved public understanding of science.

8. What do you think should be the balance between the basic research and the education programs of NSF?

Answer

I believe that the optimum balance between Science Education and basic research programs of the NSF must be viewed in the light of trends and developments in the larger society. During the 60's a major effort by the Nation to upgrade science education, lodged in NSF, was appropriate and, I believe, effective. At present, within the limits of the NSF budget, and with declining student enrollments, priority clearly should be weighted toward research. The present balance seems an appropriate one at this time.

9. What do you see as the role of NSF in supporting and improving science education?

Answer

The NSF should focus its attention on those areas of science education where the needs are so great that conventional means of development of new materials cannot respond adequately or rapidly. Publishers generally cannot afford to deviate significantly from on-going practice, nor can they ensure teacher preparation for new materials and new teaching techniques. Finally, they are usually unable to attract the highest caliber scientists and educators to textbook writing. In these areas of special need, NSF can fill the gap.

10. Do you see the organizational structure of NSF as insuring science education equitable treatment with research? Does the physical isolation of the education directorate preclude its participation in the mainstream of NSF activity?

Answer

To have Science Education geographically distant from the research directorates is not a favorable situation. I shall investigate every means of bringing the Science Education into the building now occupied by the rest of NSF.

11. Do you believe that the funding of pre-college science education should be increased?

Answer

I believe that some of the funding presently directed toward college science education should be retargeted toward the pre-high school level. Particularly the funds already identified with improvement of opportunities for minorities and women should be focused at this level. It is at this early age that minority students and girls tend to make the decision not to enter science. It is at this early age that the foundation can be provided to guarantee readiness for science at higher levels. Attacking the difficulties of minorities after they reach college is almost futile because the gap is then too large to be remedied and the cultural pressures are too deeply set to be dislodged. More minority access to the scientific and technical professions requires an early start.

12. What directions should be followed in funding science education in light of decreasing enrollments, unemployed teachers, increasing school closings, and resistance from the public to increasing tax rates?

Answer

Our needs for higher scientific literacy for the general public and for increased access of minorities and women to technical professions are urgent. The cost of an effective science education program is relatively small and shouldn't be determined by issues that must be taken into account in the much larger picture of education in general.

Responses to questions submitted by Honorable Harrison Williams, Chairman, Committee on Human Resources from Dr. F. James Rutherford, Assistant Director for Science Education.

Question 1

I am impressed that the entire panel has experience and interest in the area of science education. Dr. Pimentel, I believe that you remarked in evaluation of the Chem Study that there was a very important high school student group that your curriculum project had not assisted--those who are not interested in or inclined to study science at all. I wonder if each of you from your own particular perspectives and charge within the agency can speak to this question--particularly in the area of encouraging minorities to come into the basic sciences.

Response

I am in total agreement with the response to this question given by Dr. Pimentel. My own experience as a high school science teacher, a science curriculum developer and a researcher in science education convinces me that while an excellent job was done in providing stimulating new mathematics and science courses for the most highly motivated and academically talented, the majority of all students have been very nearly neglected. I believe that we must now turn energetically to the much more difficult task of coming to understand the needs and qualities of all students, and begin developing courses and techniques with which to serve them better. Such an effort is needed in order to help produce a generation of citizens better able to discharge their public responsibilities at a time when an understanding of science is important in dealing wisely with many important societal issues. Concomitantly it would begin to deal in a powerful and lasting way with the goal of increasing the participation of minorities, women, and the handicapped in the sciences.

Responses to questions submitted by Honorable Harrison Williams, Chairman, Committee on Human Resources from Dr. F. James Rutherford, Assistant Director for Science Education.

Question 2

One policy issue increasingly before the committee has been the role of the public in making decisions about priorities and policy in research. Particularly in the biomedical research area--with the President's Commission on Human Subjects, recent legislation to regulate the safety of DNA research and future legislative initiatives--this issue will be a real one for the committee. I wonder if each of you could provide me with your thoughts about the role of the public--particularly, in determining research priorities, in involvement at the research institution level and in national policy making.

Response

I am convinced that the general public has an important role to play in the decision-making process that leads to the setting of national research policy. It is not at all clear in my mind at this time just how the responsibility can be divided between the public and the scientific community, or on how the process would work in practice. However, what is certain, I believe, is that it will not be possible to work out any satisfactory system of divided authority unless and until there is a much fuller public understanding of science than now exists. As I pointed out in response to your first question, we have neglected the majority of our students as far as science education is concerned--and yet they too are the "general public." Even our colleges do not, for the most part, prepare either their science or non-science students to deal with the value and social questions related to science and technology. It is for this reason, among others, I hope to lead the science Education Directorate into an intense and persistent effort to improve the science instruction of all students.

Responses to questions submitted by Honorable Harrison Williams, Chairman, Committee on Human Resources from Dr. F. James Rutherford, Assistant Director for Science Education.

Question 3

Information regarding CIA drug experimentation on unwitting subjects as well as experiments on prisoners and other institutionalized persons raise the question of the need for basic standards in research. Do you believe that there can be standards of conduct and ethics in science--in research and teaching--which can be openly arrived at and agreed to by the research community? Is there a proper role for NSF in encouraging the adoption of such standards? Is there a proper role for the public?

Response

I find this in some ways a difficult question. It is my strong belief that there ought to be high standards of conduct and ethics in both scientific research and science teaching. Indeed, research is itself based on a set of implicit but impressive value standards, and until recently scientists had little reason to question them.

But now scientific research is closely associated with questions of social policy and individual welfare, and it is less clear than before just what the effect of new scientific knowledge will be on individuals and society as a whole. This is a subject to which NSF and many others are giving increased attention and properly so. I believe we should make every effort to bring together scientists and the public in a continuing dialogue in this area. The role of the Education Directorate in this should, I believe, be a double one. First, it should support thoughtful scholarship intended to explore the issues and bring them to the attention of scientists, students and the general public. Second, it should support efforts to promote open, productive discussion of ethical questions between scientists and citizens.

Response to question submitted by Honorable Edward M. Kennedy, Chairman, Subcommittee on Health and Scientific Research, from Dr. F. James Rutherford, Assistant Director for Science Education.

Subject: Minorities and the Poor in Science

Question: This Committee has a continuing concern over the underrepresentation of minorities and students from economically deprived areas in science and engineering. The Congress has authorized a program and resource center for science and engineering, under which planning grants have been awarded to develop proposals for the establishment of these centers to encourage such students to become involved in these careers.

Assuming that the planning grants result in a substantial number of strong proposals, would you support expansion of the program in the budget as prepared by the Foundation and submitted to the Office of Management and Budget?

If not, what alternatives do you see as appropriate remedies for this underrepresentation?

Answer:

Yes, I would support expansion of the resource center program in order to initiate several centers. My understanding is that the program aspect of the authorization goes beyond the establishment of the single center during the coming year.

We will soon receive proposals from holders of planning grants as well as from others who are eligible to submit. Inasmuch as the centers alone cannot provide a lasting solution to the problem of underrepresentation, it will be necessary to pursue other avenues simultaneously. In particular we must begin to attack the problem when it first manifests itself, which is before children even reach high school.

Responses to questions submitted by Honorable Edward M. Kennedy, Chairman, Subcommittee on Health and Scientific Research, from Dr. F. James Rutherford, Assistant Director for Science Education.

Question:

1. For the past five or six years, NSF has had no long-range plan for science education and budget requests for programs show no sustained pattern. After your "settling-in" period, will you prepare a long-range plan for the Education Directorate?

Answer:

Whatever the situation may have been in the recent past, I strongly feel that the Science Education Directorate cannot influence the future unless it does develop a thoughtful, informed and imaginative long-range plan. I see no reason to spend much time settling in and will begin immediately to design a plan of action that addresses what I believe are currently the chief needs in science education. In constructing the plan I will seek extensive internal and external advice including constituents, other Federal agencies and interested Congressional committees.

Perhaps I should indicate now what I think the most urgent needs are in science education. Briefly stated, these are: to broaden participation in science; and to build a strong knowledge base upon which to achieve the reform in science education.

Question:

2. How do you view the proposed Education Directorate inclusion in a Department of Education?

Answer:

Based on the sketchy descriptions I have seen of the form that a Department of Education might take, I would be very reluctant to see the Science Education Directorate transferred. This is not because I would oppose a Department of Education, for on the contrary I tend to believe that such a department would make sense. It could very well bring together many of the education activities now scattered through various agencies, and it would provide long overdue recognition of the central place that education in fact has in our society.

As I understand it, the proposed Department of Education would focus most of its attention and resources on such important public needs as achieving equity, insuring basic support for every school in the land, coordinating activities between local and national education agencies, and providing leadership in setting standards. However, I would not expect such a department to have the capability of concentrating intensely on particular content areas. The NSF has the ability to restrict and intensify its attention of the specific problems of teaching of science and mathematics, and this could be lost by a move. The Science Education Directorate's greatest strength may be that it is uniquely qualified by organizational position and 20 years of experience to work successfully with both the scientific community and educational practitioners.

Question:

3. What should be the highest priority for the Science Education Directorate in the allocation of funds? Should the emphasis be on elementary, secondary, undergraduate-level education? Should the emphasis be on teacher education?

Answer:

In my judgment the major purpose of the Science Education Directorate ought to be to foster the broadest possible participation in science. This means initiating and supporting those activities that will (1) find ways to provide all students--irrespective of family background, academic talent or career ambitions--with an understanding of science necessary for responsible citizenship in today's world; (2) increase the opportunities for adults to gain scientific information and to interact with scientists as they deal with science and technology-related societal issues; and (3) recruit professional scientists and engineers from underrepresented groups--the poor, the minorities, women and the handicapped.

To bring this about will, I believe, require four steps: (1) The reform of college science education so that it serves the proper needs of all students, not just science majors. Since most undergraduates (especially those underrepresented in the sciences) go to four-year colleges and two-year colleges rather than to the large research universities, there should be a concentration on such institutions to strengthen their science programs generally.

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(2) Strengthening and enlarging programs such as the existing Public Understanding of Science and the Science for Citizens program as a way to quickly increase adult use of and support for science.

(3) Developing a more vigorous, penetrating and carefully targeted research and development effort in science education than now exists. In order to bring about major reforms in science and mathematics instruction, we need to know more than we know now, which is to say that we need to gain a scientific understanding of science learning.

(4) A major overhaul of junior high school science and mathematics.

Of these four steps, the first three can be accomplished by modification and extension of existing programs, but the last one will require an entirely new thrust. Let me try, therefore, to indicate why I feel so strongly that high priority be given to the improvement of junior high school science. Some of my reasons for wanting to concentrate special effort on curriculum development, teaching training and research and development at this level include: (1) Most students receive no more than four years of formal science instruction in their lives, and three of those are in junior high school. (2) By the end of the ninth grade, minorities and girls have largely decided that they cannot become scientists and in effect drop out of science once and for all. (3) Science education at that level has long been ignored, never having received the attention accorded elementary and high school science teaching.

Answer 3 continued - 3 -

A program to bring about a significant improvement in junior high school science should incorporate a balanced combination of curriculum development, teacher education and research.

Question:

4. What is the role of research in the improvement of science education, and under whose auspices should that research be carried out?

Answer:

One of the immediate tasks I would expect to accomplish is the design of a research program in science and mathematics education. The intension would be first to identify those few lines of research that hold the most promise of generating penetrating insights to the learning process. Each of these research thrusts will be carefully delineated in order to express to the research community the Foundation's priorities in this area and to guide program officers. Part of the plan will include provision for periodic review by researchers and practitioners of what progress is being made so that each line of research can be adjusted as necessary to stay on target.

Implicit in my wish to greatly increase the Education Directorate's research effort is the belief that it is the appropriate agency. It has the model of the research directorates to follow, working contacts with both the research and science teaching communities, and a mission that can directly and quickly capitalize on research progress, as well as providing the substance of the research studies.

Question:

5. What opportunities are there in the current NSF education programs and in the structure of the Directorate for Science Education to conduct (either in-house or through grants and contracts) exploratory, diagnostic or other activities necessary for policy and program planning?

Answer:

The Office of Program Integration has been established to provide long-range planning and program evaluation services to the Science Education Directorate. This office is organizationally independent of the staff that makes program award recommendations and monitors projects. Its major responsibility is to provide, through staff studies and external contracts, the program reviews, evaluations and needs assessments that are necessary for long-range planning.

Examples of activities of OPI include: 3 contracts for science education needs assessment on the pre-college level and contracts just getting underway to evaluate five Science Education Directorate programs. Using in-house resources, OPI has recently conducted an evaluation of a set of projects designed to upgrade the science training of women and facilitate reentry into the job market of women with science training who are unemployed or underemployed.

Question:

6. Are you satisfied with the ways in which the Foundation gets advice and evaluation of its education program direction? Of its individual programs?

Answer:

At this time, I do not have much first hand knowledge of how satisfactorily the advice and evaluation mechanisms are working for the Science Education Directorate. These are advisory groups in place and a series of external reviews of the individual programs has been instituted. If I find that these do not provide the critical help I believe we need, then I will not hesitate to look for ways to improve the process.

Question:

7. How would you alter or add to the Foundation's effort to improve science education and opportunities for women, minorities and handicapped individuals--the underserved and underrepresented majority of our society?

Answer:

As I indicated earlier, I believe that the Science Education Directorate's efforts should concentrate on the goal of improving science education and science career opportunities for those whom we have largely bypassed. The underserved and underrepresented do, as you rightly suggest, constitute the majority of our society. In trying to correct this unacceptable state of affairs, targeted programs, such as MISIP, be continued even while the unsheltered programs, such as CAUSE, strive to broaden participation. To the degree they are successful, the targeted programs should eventually eliminate the need for their continued existence. This is to say that the problem has manifestations at all levels of education, and all need attention.

However, in order to bring about a permanent remedy, it will be necessary, I believe, to launch a major attack on the problem at the junior high school years. As I indicated earlier the period of early adolescence is the critical time for youngsters as far as preserving their opportunities for the future, and particularly so in science.

Question:

8. Does the peer review process serve its purposes well in science education? Are the functions of peer review in the Directorate for Science Education the same or different from those in the so-called "research directorates"?

Answer:

Historically, NSF has provided only a tiny fraction of the total of federal expenditures for education. Nevertheless, the Science Education Activity of NSF has had a significant impact. The cornerstone of Science Education's approach (as well as for NSF as a whole) is the funding of high-quality projects through a competitive process. This approach (in contrast to an entitlement approach) contributes to leverage in a number of ways. First, it assures that money is spent on only the very best projects. Secondly, there is a prestige factor associated with a competitive NSF award that has a ripple effect. Awarded projects, of assured quality, set examples and establish standards for others to follow. Third, the writing of proposals for competition helps the proposing individuals and organization formulate their science education problems more clearly, and this can have a certain benefit, even if an award is not forthcoming. I believe that the considerable effort expended in communicating the reasons for denial to unsuccessful applicants facilitates this process and has a significant payoff for the system as a whole.

The peer review process is the key to making the approach work. In Science Education, "peer" is defined in a way appropriate to the problem at hand. For example, proposals for the development of instructional

materials will be reviewed by teachers and prospective users as well as by "peers" of the proposer defined in a narrow sense. We strive also on review panels to have a balance in terms of geography, sex, and minority status. Problems of equity are dealt with in this way as well as by appropriately formulating the rules of competition through explicit criteria.

In summary, the purpose of peer review in Science Education is the same as those in the research directorates--to select quality projects. Science Education, however, conducts peer review in a manner appropriate to its objectives which is reflected in the range and mix of reviewer skill and interest, and in the review criteria used.

Question:

9. How can the Directorate improve its working relations with its constituency?

Answer:

The Science Education Directorate has many constituencies. There are, of course, categories of people, such as elementary school teachers, junior and senior high school science teachers, college science teachers, university and industrial scientists, science teacher trainees, and educational researchers. Also there are many institutional constituencies, including science museums, libraries and television, in addition to schools, colleges and universities. The problem is how to maintain interaction with so many different constituencies.

I will attempt to use a variety of approaches to this problem. One is through the scientific and science teaching societies. I believe I have good relations with such organizations as the American Association for the Advancement of Science, the National Science Teachers Association, the National Association for Research and Science Teaching, the Association for the Education of Teachers in Science, the American Association of Physics Teachers, the Council of Scientific Society Presidents, and others. My staff and I will look to them for guidance in serving the science education communities. Also, I would expect to establish open communications with the various education oriented organizations, such as the American Council on

Education, the American Association of Community and Junior Colleges and the National Education Association, the Association of Science-Technology Centers. Working relations with constituencies in special categories, such as minorities, women and handicapped, and be established through advisory committees and through contact with those national programs or subgroups within organizations, e.g. the Office of Opportunities in Science of the AAAS, that have special concern and knowledge.

Finally, I hope that the resources can be found to enable the program officers to devote a larger fraction of their time to personal contact with our clientele in the field. As Assistant Director for Science Education I believe that one of my chief duties will be to insist that we continually present our ideas and programs to our various constituencies, and to this end I will personally meet with constituency groups as often as possible.

Question:

10. In the past two years, morale reports for Science Education Directorate staff have been very low. What plans do you have for raising your staff's morale? Do you plan any program of professional development for them?

Answer:

In my judgment, the best way to raise staff morale is to involve them in a vigorous new thrust, one that they believe in and that addresses itself to importance. The staff is, I believe, an excellent one, but the last half dozen years have been especially difficult for them for many well known reasons. In the 60's they had a well defined mission, knew what they had to do, and for the most part did it with energy, imagination and high spirits. They knew they were doing important work and where they were headed. Since about 1970 this sense of direction and purpose has, I believe, been missing, and hence the recent cut-backs and public criticisms have been all the more devastating. If I can succeed in articulating ambitious new goals that make good sense to them, to the Administration and to Congress, then I have no doubt that the staff will go to work with me to achieve those goals. If so, the morale problem should largely take care of itself.

Question:

11. In what ways, if any, should NSF be involved in the development of curricula in science and mathematics?

Answer:

I strongly support the view that once again NSF should become involved in curriculum development in science and mathematics.

First, I would like to suggest that instead of concentrating on developing science courses for our most highly motivated students, the effort this time must be to develop courses and methods that will serve all of the other students, namely the majority bypassed in the earlier effort.

Second, It seems clear to me that our new curriculum effort should concentrate on the very crucial years of early adolescence. In the junior high schools is where most students receive most of their formal science instruction.

Third, I am not at all convinced that the model of curriculum development used in the 60's is appropriate for the new task. For sound pedagogic, psychological, economic and political reasons, it is important to build on our experience of the 60's in curriculum development without trying to duplicate it. In this respect, one new idea I would wish to explore is the possibility of producing a large pool of curriculum materials (teaching units, activities, data films, computer programs. etc.) from the local school districts

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and publishers could freely design their own junior high school science programs. This might avoid some of the problems explicit in developing large scale, tightly designed courses that for one reason or another cannot be used intact by the schools and that are uneconomical for publishers to invest in.

Finally, it should be noted that any new curriculum effort should deliberately strive for diversity. By simultaneously supporting several high quality efforts for any particular grade level that differ from each other in philosophy and approach, the schools could be assured a greater spectrum of choice and any concerns about monolithic science curriculum would be dispelled.

Question:

12. Do you support the view that science teachers need continuous programs to update their education?

Answer:

I suppose that teachers in all fields need periodic updating, but I know that science teachers do. Scientific knowledge grows too rapidly for preservice preparation to suffice for an entire career of teaching. To go more than five years without updating in one's field is to become professionally obsolete.

But the need for continuing science teachers education is greater than just staying up-to-date in one's field. Science teachers need to be prepared to deal with current societal issues that are related to their field. Currently, for example, there is great public interest in issues such as energy, environmental protection, population, the control of scientific experimentation and the applications of science and technology, such as computers and nuclear reactors. Science teachers need to help their students understand the scientific components of such problems, although they themselves often do not have suitable preparation for handling science-related social issues. Continuing education is needed, I believe, for this purpose as well as for subject-matter updating.

Question:

13. Should funding be increased to broaden and update the education of science teachers by means of endeavors such as summer institutes, academic year institutes, etc?

Answer:

While the NSF does not have the sole responsibility for the continuous upgrading of science and mathematics teachers it does, I believe, have a crucial role. Funding should be substantially increased in the next few years. By emphasizing locally developed and attended school-college cooperative institutes rather than national ones, I believe it is possible to increase the frequency and value of continuing study for science teachers. Such programs should deal with some of the latest developments in science, inform the teachers on new methods and materials, and help them work out ways and means for achieving full participation in science of all students in their schools. In allotting whatever funds become available for this purpose, I would assign priority to providing help to junior high school science and mathematics teachers.

Question:

14. What do you think are the most important problems or needs in pre-college science education?

Answer:

I have covered many of these points in my answer to some of the other questions. By way of summary, I think we must now turn our attention to the students who are not by inclination or ability likely to end up in the sciences. For amny reasons related to the importance of the early adolescent years, to the structure of the American school system, to social concerns and to history, I believe that there should be a special focus on the junior high school years.

Question:

15. Do you believe that students at the pre-college level today are not as well prepared in science as were the students of the 1960's? If so, what are the reasons for this?

Answer:

Preliminary findings of studies we are conducting show that less science is being taught to and learned by the great bulk of students. In elementary schools financial pressures and the back-to-basics movement have led to a decrease in amount of time spent on science. Science is not considered a basic (although mathematics is). At the senior high school level, advanced science courses are viewed as elitist and fewer students other than the scientifically motivated and talented are electing to take science beyond required general courses.

This is all reflected by the well-publicized decline in test scores. Scientifically motivated and talented students are studying as much science and performing as well or better on standardized tests as they have in the past. Other students are studying less science and appear to be performing less well on tests.

The reasons for this decrease in science instruction are undoubtedly complex. However a significant factor is that science is not seen as a "basic" but as the exclusive province of scientists, and the scientifically talented and motivated. In my statement to the Committee on Human Resources I affirmed the broadening of participation in science as my primary goal as Assistant Director for Science Education.

Question:

16. Do you recommend that schools spend more time at the pre-college level on teaching the "basics"? Is science thought of as one of the "basics"?

Answer:

It is difficult to respond to questions about the "basics" because of the strong but varied meanings attached to the term. I believe that parents and communities have a right to expect that the youngsters coming out of their schools can read and learn from their reading, can express ideas orally and in writing, and can handle numbers sufficiently well to get by in today's numerical world. Such training, however, is not sufficient for contemporary citizens. For many careers a significant knowledge of mathematics and science is necessary. Failure to obtain continuous instruction in those fields through high school especially eliminates students from any opportunity for technical, scientific or engineering occupations. In this sense science and mathematics is indeed basic, for students who are deprived of it are excluded from full participation in the world or work.

In addition, science can reasonably be thought of as "a basic subject" because it is so essential for an understanding of today's world and because scientific knowledge is now an important condition for responsible citizenship. As it turns out, science can be taught in ways that help pupils to learn read and compute better; thus there is little reason to fear that increasing the amount of science instruction would deprive students of the basics.

Question:

17. The Science for Citizens program is directed by its legislation to help citizens and citizen groups better understand the technical aspects of public policy debates in which they are involved. The NSF to date has tried to serve those citizen groups which are grass roots oriented and which are actively involved in important public issues.

    Of the conferences funded in FY 1977, 38% were hosted by citizens or public interest groups; 53% of the conferences were hosted by universities, colleges, or research organizations. Do you think that these groups are in touch with the basic goals and needs of grass roots citizen groups? Do you think this 38%-53% funding pattern best serves the needs of the citizen groups?

Answer:

The numerical distribution of FY 1977 Science for Citizens (SFC) grants between citizen groups and educational institutions does not by itself reflect the program's emphasis on activities intended to address directly the needs of citizens and their organizations. All grants, including those made to colleges, universities, and research organizations, involve citizens' groups, either as co-sponsors or as active participants in the planning and execution of activities sponsored by others. I agree that one of the main goals of the program should be to encourage the development of scientific expertise at the grass roots level, and SFC activities in FY 1978 will be designed with this objective in mind.

Question:

18. In line with the above question, I have another regarding how well the NSF serves black and minority groups. In FY 1977 no blacks, no Asians and no Indians received a Resident or Intern award. Only one Hispanic American received a Resident award. What is your reaction to this performance? Do you think that adding a minority staff member with community relations skills could help remedy this neglect of minorities?

Answer:

I share your concern about the low proportion of Science for Citizens (SFC) awards to black and minority groups; so does the SFC Advisory Committee, which has expressed its views in this matter very forcibly in its final report to the Director of NSF. However, this problem does not, I believe, result from neglect by SFC program staff, and it is not an easy problem to solve. Judging by the first year of experience, the total number of scientists and engineers (and students of science and engineering) prepared to leave conventional career lines for public service work is small, and the number of black and minority members of this group is smaller still. It is not clear to me how "a minority staff member with community relations skills" would remedy this situation within the scientific community, but that the problem must be more directly addressed in FY 1978 I have no doubt. In particular, a more intensive effort must be made to enlarge the pool of black and minority applicants to the program.

Question:

19. I understand that the Office of Management and Budget wishes to either abolish the Science for Citizens Advisory Committee or to subsume it into a larger Science and Society Advisory Committee. My concern is that the Science for Citizens program differs sufficiently from other NSF programs to warrant its own active advisory group? What is your opinion on this?

Answer:

I have been concerned by the OMB desire to abolish not only the SFC Advisory Committee but also the Advisory Committees for the Public Understanding of Science program and the Ethics and Values in Science and Technology program. Each of these programs involves activities and constituencies that differ considerably from the others and from other NSF programs. At the same time, I believe that the language regarding the Office of Science and Society that appears in the NSF Authorization Act for 1978 provides a desirable opportunity to integrate the work of these three programs more effectively and to strengthen their base within the NSF. For this reason, I support the establishment of a larger Advisory Committee on Science and Society, which can deal both with general policy questions and (through the work of subcommittees) with the distinctive activities of the separate programs.

Questions:

20. Since the Science for Citizens program is designed to serve a grass roots constituency, don't you think that some form of decentralized grant-making organization may be in order? The exact form of this organization would have to be worked out in detail, of course, and NSF would want to maintain control over the scientific quality of work being done. For example, regional or local Science for Citizens centers could nominate the Residents and Interns that NSF would make its awards to. How do you react in general to this type of federal-local decision-making process?

Answer:

Some form of decentralized grant-making appears to me desirable in terms of SFC objectives; in principle, it should permit a more rapid and more flexible response to community needs. At the same time, the problems of such a delegation of NSF responsibility are considerable, and there are some activities that are probably best left under centralized control. The SFC Advisory Committee has recommended the development of local and regional centers that might be given limited authority to conduct their own activities, including the nomination of Residents and Interns and the support of forums, conferences, and workshops. We will be working with these ideas during FY 1978, to initiate a plan leading to the development of workable institutions and mechanisms of this kind.

Question:

21. I notice that no grants were made in the area of appropriate technology in FY 1977. With the nation's interest in solar energy and energy conservation, as well as government support of these activities within ERDA and the Community Services Administration, don't you think it appropriate for NSF to fund appropriate technology?

Answer:

As far as can be ascertained from the nature of proposals submitted in FY 1977, the science education community has not yet placed a high priority on the formal teaching of the subject of appropriate technology. It is likely that the perception is that while appropriate technology deserves research attention from academia, it still is not sufficiently developed to be able to be taught in a systematic way.

My observation is that the Science Education Directorate is receptive to well-conceived efforts in appropriate technology even when they are not identified as such. For example, anticipating a demand, Michael Lowenstein is heading a cooperative four-institution project, funded by the Science Education Directorate, to develop a two-year associate degree program for solar energy technicians. Navarro College, the project center, together with Brevard Community College, Cerro Coso Community College, and Dallas County Community College will develop the necessary courses in solar measurement, energy economics, conservation, and commercial systems.

Responses to Questions
Submitted by

Honorable Harrison Williams,
Chairman, Committee on Human Resources

to

John B. Slaughter
Assistant Director for Astronomical,
Atmospheric, Earth, and Ocean Sciences

October 19, 1977

1. There are two roles I can perform in assisting the National Science Foundation implement its program of increasing the involvement of minorities in the field of science. The first of these roles is somewhat unique within the top management of the Foundation because I am a minority. As a member of the senior management of the Foundation I can provide the important function of serving as a role model, which is perhaps one of the key ingredients in enhancing the participation of minorities in science and engineering. As a role model I can at least provide some encouragement, if not proof, to minority young people that there are opportunities for them to occupy key, important positions in science whether it be with universities, industry, or government.

The second role that I can play is to assist in the development of Foundation policy and to serve as an articulator of those policies, both within and outside the Federal Government. I have been involved in similar activities for the length of my professional career and I will consider this opportunity to make a contribution a most valuable and timely one.

2. The second question is a very thoughtful one and is one that requires very careful consideration by the Congress and Federal agencies such as the National Science Foundation. In general it is my firm opinion that the public must be involved in the development of research priorities and in the establishment of science policy making. That involvement can take many forms. I would argue that to a large extent the public is already involved in these functions. Perhaps we have not made optimum use of the public up until this point, but I believe that we are all aware of the importance of interacting with individuals and groups in order to gain sufficient insight to carry out our efforts intelligently. I am a firm believer in the concept that wisdom concerning any subject of importance to the country can be found in a variety of locales and from listening to a lot of people. We must never assume that those of us who have been chosen to be responsible for particular aspects of policy making are inherently blessed with all the knowledge necessary to determine priorities and make decisions. Conducting forums in the local communities, soliciting the thoughts of citizens throughout the country, and providing as much information to the public as possible represent ways in which we can ensure that a dialogue occurs and that an opportunity for input exists.

3. I would strongly argue that there are operating standards of conduct and ethics in science, research and teaching. I believe that these standards have evolved from many years of activities on the parts of the research community and the public at large. The difficulty with standards occurs in the kinds of circumstances which were brought about by the CIA drug experimentation to which you alluded in your question. It is my belief that society sometimes eschews standards of conduct if it is perceived that those standards somehow militate against performance of a high service for the country. This happens during war and we see it happening in the particular experience which you mentioned. The responsibility therefore to a large extent falls upon the shoulders of the government to establish standards which do not impinge upon the professional standards of the scientists, researcher, and medical practitioner and others in those disciplines which are involved in carrying out the will of the government. The issue is a complex one--it is not as simple as the establishment of a code of conduct for the professional person.

John B. Slaughter

Responses to Questions
Submitted by

Honorable Edward M. Kennedy
Chairman, Subcommittee on Health
and Scientific Research

to

John B. Slaughter
Assistant Director for Astronomical,
Atmospheric, Earth and Ocean Sciences

October 19, 1977

Question:

1.a. How does the Foundation plan to respond to the President's initiative? (To strengthen its commitment to basic research)

A. This question logically could be answered in the affirmative by stating that the Foundation intends to (1) increase the percentage of its funds obligated for basic research, (2) increase the absolute amount of its basic research funding, or (3) strengthen its efforts aimed at encouraging the mission agencies to increase their support of basic research. Since the Foundation intends to respond affirmatively to the President's initiative, I will examine each alternative in turn.

The percentage of obligations devoted to basic research is an inappropriate measure of the Foundation's commitment to basic research. Applied research is an integral part of the Foundation's research effort. Recent history has demonstrated a need for the Foundation to support development of certain ideas to the point where their importance can be recognized by the mission agencies. Many of these ideas spring from the Foundation's traditional clientele, the academic community, so it is only natural that we serve as the incubator of applied research developments.

There can be no doubt that the Foundation would appreciate the opportunity to strengthen its commitment to basic research by increasing the absolute amount of basic research funding.

Finally, encouraging participation of mission agencies in the support of basic research has been an important Foundation effort for a number of years and will remain so. The National Science Board is on Record with a resolution urging agencies to increase their support of basic research, and NSF as an agency attempts to convey this message whenever possible.

Question:

1.b. Can the Foundation strengthen its commitment to basic research? If so, how?

A. The Foundation's commitment to basic research is already very strong. It might act to strengthen the Nation's commitment to basic research by supporting an enhanced role for the Science Adviser in examining the basic research component of mission agency budgets and recommending an appropriate balance between basic research, applied research, and development at the mission agencies.

Question:

1.c. In your opinion has too much emphasis been placed by NSF and others on applied research to the detriment of basic research programs?

A. A distinction must be drawn between applied research and problem-focused research. Since the Foundation does not have a mission comparable to that of the mission agencies, problem-focused research can be justified when short-term payoffs are evident or when an area is being developed for integration into the programs of a mission agency. Applied research is an integral part of the NSF's mission. It typically can only be distinguished from basic research by the investigator's statement that there might be practical applications. In my opinion, applied research is receiving too little emphasis. Much concern has been expressed in the Nation's press about the lack of innovations and innovators in the U.S. A greater role for applied research may well help to remedy those concerns. In addition, important perspectives are gained by having both applied and basic research supported by an agency that has a network of ties with the academic community. The potential for following-up breakthroughs in research, for using interdisciplinary research groups, and enhancing the interaction between industry and universities would seem to be increased.

Question:

2.a. Basic Research Stability Grant Program. (The current program level would seem insufficient to meet the need.)
What level of support should be provided? Would a level equal to 5 percent or 10 percent of the project support provide an optimum balance? What is the need that Basic Research Stability Grants (BRSG) fill?

A. If BRSG's are to "supplement and undergird the competitive project awards" by providing small sums of flexible funds, a large range of needs would appear to be excluded. For example, purchase of permanent equipment, long-term salary support, and general purpose equipment would be difficult to justify. BRSG funds might reasonably provide minimal equipment and supplies needed to develop a new idea to the proposal stage, perhaps with the aid of an existing large apparatus. They might also cover exceptional research needs that could not reasonably be anticipated, but an important point to note is that this type of expenditure normally is reimbursed by the funding agency. In summary, the only non-reimbursable expenses that are likely to be incurred under a BRSG are short-term technical assistance and expendable equipment. There is a real limit to the amount that can profitably be obligated for such purposes, but some other aspects of the problem must be examined before answering this question.

Basic Research Stability Grants raise a number of nonfiscal questions. It is my belief that the Foundation should not provide institutional support. Institutional support cannot be justified in the long-term research support picture; it can only be justified as a short-term measure addressing a particular national need. To the extent that BRSG's provide institutional support by relieving the universities of their responsibility to fund development of their promising young scientists and maintain the quality of their research infrastructure, they (in the long-term picture) are an unwarrantable replacement of private and state funds with Federal funds. Is there a short-term need for BRSG's? Studies of the NSF's peer review system have shown that it does not discriminate against the young investigator. In fact, the real problem is the shortage of young investigators on university faculty; BRSG's can do little to solve this problem.

It is true that the national interest would be served by enabling investigators to indulge in quick pursuit of a research idea. Funded investigators already have this option. In fact, NSF program managers hope and expect that their investigators will pursue hot ideas. Therefore, funded investigators do not need BRSG's.

98-146 O - 77 - 7

Question 2.a. (con't)

Unfunded investigators need BRSG's to test new ideas, but these funds must be kept small to avoid supplanting the peer review process. Certainly, no more than one percent of NSF funds should go into BRSG's.

Question:

2.b. Should a direct funding relationship be established between the project funds and the Basic Research Stability Grant Program? Should the two be tied together?

A. Since the institutions that receive the largest amount of project funds least need BRSG's, the two should not be tied together. Many promising young scientists have been forced to accept appointments at small institutions that do not have access to endowment and other funds to defray the costs of establishing research programs. These institutions should receive the bulk of the BRSG funds.

Question:

3.a. What is the condition of scientific instrumentation in the Nation's research laboratories?

A. It is a sign of the health of the disciplines supported by AAEO that they recognize the need for new instrumentation and are continuing their efforts to maintain the competitive position of U.S. science. A number of mechanisms provide input on instrumentation needs to AAEO. The national centers in astronomy and atmospheric sciences serve as a foci of instrumentation developments that propagate throughout the research community. Ocean Sciences is planning large scale research for the 1980's. Not suprisingly, many of the desirable programs require development of new instrumentation. Earth Sciences recently conducted a survey to determine the need for instrumentation; we intend to provide for some of these needs in future budgets. Finally, our research in the polar regions needs new research capabilities, if we are to continue our rate of progress in understanding these important parts of the globe.

I cannot say that everyone is satisfied with the amount and variety of instrumentation provided by AAEO funding. However, where legitimate needs have been demonstrated, we are acting to provide for them.

Question:

3.b. Will equipment continue to be a pressing need and a priority for the Foundation?

A. Equipment will always be a priority for the Foundation, and particularly for AAEO. New types of equipment must be developed, if the programs anticipated in the 1980's are to be carried out and the health and forward momentum of basic science maintained.

Question:

4.a. Are the problems confronting research libraries affecting the Foundation's research programs in universities? If so, how?

A. The problems of research libraries have had no noticeable impact on the Foundation's research programs in universities.

Question:

4.b. What steps might NSF take to address the research-related needs of the Nation's major libraries?

A. Normal Library Services are part of the infrastructure that universities expecting to compete successfully for research funds should support from their own resources. When libraries contribute to the research effort, by maintaining specimen collections or providing data processing services, they can apply for and receive research funds. NSF's support of research in the information sciences can have important long-term consequences for university libraries and library systems generally. NSF should not, however, be in the role of providing sustaining support for science libraries.

Question:

5.a. Falling Number of Young Faculty. Is this a long-range problem or is it a short-term problem which will correct itself in several years?

A. The falling number of young faculty is a problem that is most effectively addressed by individual universities. A number of universities have already confronted the problem and adopted stringent measures to ensure turnover of faculty. As the situation worsens, more universities will develop their own solutions to the problem, and in doing so will-hopefully-make it a short-term problem.

Question:

5.b. What role do you feel the NSF should play in addressing this problem?

A. Ultimately, this problem only will be solved by universities acting on their own to encourage early retirement of older faculty. Universities that fail to do so will gradually lose their ability to compete for research funds, and this will be an even greater incentive for change than special programs. In the meantime, the Foundation should continue its policies that allow support of postdoctoral fellows, non-tenured faculty, and research associates, as long as they contribute to the research effort.

Question:

6. Report Requirements and Proposal Writing. Do you believe that this is a significant problem among NSF investigators? If so, what can be done to reduce this distracting burden?

A. The NSF has recognized this problem and taken steps to remedy it. Investigators may request up to five years' support. If the peer review process confirms the need for long-term support, it is provided either through a continuing grant that requires only annual progress reports or through a single multi-year award. It is too early to tell whether widespread use of these instruments has eliminated the problem.

Question:

7. Resource Centers for Science and Engineering. Assuming that the planning grants result in a substantial number of strong proposals, would you support expansion of the program in the budget as prepared by the Foundation and submitted to the Office of Management and Budget?

A. Resource Centers for Science and Engineering combine a number of elements essential to a coherent attack on the problems that typically have limited minority participation in science. The problems are: tracking of minority students out of academic programs at the junior high school level (thereby depriving them of the mathematics and science background needed to pursue a career in any technical field), and lack of exposure to opportunities in science (role models and simple exposure to the opportunities that exist are essential to bringing new segments of the population into the scientific/technical labor force).

By developing a strong research program in the midst of a predominantly minority and/or impoverished population, Resource Centers will attract talented scientists. Then, they, by focusing some share of their time on the problem of developing minority scientists, will attract the kind of interest and human and financial resources necessary to adequately address the problem of minority participation in science. Therefore, the key to the success of the Resource Centers is the strength of the research program and the willingness of the researchers to direct the educational aspects of the Centers.

A second key is the strength of the staff carrying out educational aspects of the Centers. They must be able to work with all parts of the public communication media, the local school systems, industrial firms, etc. Their aims are to provide forums for discussion and removal of the barriers to minority participation in science and to establish continuing opportunities for exposure of minority/impoverished students to science.

These are big tasks to undertake. If the Centers are to be effective, each must be adequately managed and funded. For this reason, although I would like to see about five such Centers eventually, I think it is more important to concentrate on one or two high quality Centers in the near term.

United States Senate
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION
WASHINGTON, D.C. 20510

September 26th 1977

The Honorable Harrison A. Williams
Chairman
Human Resources Committee
352 Senate Office Building
Washington, D.C.

Dear Mr. Chairman:

It is my understanding your Committee will be holding hearings tomorrow on the nomination of John Brooks Slaughter to be an Assistant Director of the National Science Foundation and I would certainly like to say a few words in his behalf.

Dr. Slaughter has been the Director of the Applied Physics Laboratory at the University of Washington, serving with distinction in that important post out home and highly regarded by his colleagues at the U-W, as well as business and civic leaders throughout the Pacific Northwest. His professional background in engineering and most recent assignments made him a logical choice for the position at NSF as Assistant Director responsible for their activities in the astronomical, atmospheric, earth and ocean sciences. His experience in private business, the Navy and academic world, combine to recommend him for that position and I commend those within the Executive and at NSF for their selection.

While I have not known John for any great length of time, I have no hesitancy in adding my support to those who have recommended him for this highly important position. I know that you will find him most personable and I hope you will agree that he is highly qualified to become an Assistant Director of the National Science Foundation.

With kindest regards, I remain

Sincerely,

Magnuson

WARREN G. MAGNUSON, U. S. S.

WGM/wfr
11
cc: Senator Kennedy

MASSACHUSETTS INSTITUTE OF TECHNOLOGY CAMBRIDGE, MASSACHUSETTS 02139

Bldg. 20D-213

22 September 1977

Senator Harrison Wilson
Senate Office Building
Washington, DC 20510

Dear Senator:

I understand you are holding a hearing on September 26 on the appointment of Dr. F. James Rutherford to the position of Assistant Director for Education at NSF. This is to express my regret that I shall not be able to attend, but at the same time I wish at least briefly to register my strong support for this appointment. I have known Dr. Rutherford in both a professional and a personal capacity for over 15 years. He has taken on highly responsible and difficult tasks in science education and to my knowledge has invariably been successful, fair, and worthy of the trust placed in him by all who work with or under him. His views of the needs and opportunities for science education in this country seem to me balanced and well informed. The NSF and the nation will be well served by the appointment and by the leadership of this experienced and thoughtful person.

Sincerely yours,

Gerald Holton
Visiting Professor of Physics
and of History of Science

GLCA

GREAT LAKES COLLEGES ASSOCIATION, 220 COLLINGWOOD, SUITE 240, ANN ARBOR, MICHIGAN 48103 (313) 761-4833

September 23, 1977

The Honorable Harrison A. Williams
Chairman
Senate Committee on Human Resources
352 Russell Senate Office Building
Washington, D.C. 20510

Dear Senator Williams:

The Great Lakes Colleges Association, a consortium of twelve undergraduate liberal arts institutions, is grateful for the opportunity to endorse the nomination of George C. Pimentel as Deputy Director of the National Science Foundation.

Many of our scientists know Dr. Pimentel and his work. Some of their comments may indicate the enthusiasm Dr. Pimentel inspires not only as a scientist and educator but as a friend and mentor:

> "There's no question about his competence. He is smart, innovative and a helluva good scientist."
>
> "Pimentel is a man who has excelled in research but has also been an outstanding educator and will be understanding of our institutions."
>
> "I have the highest regard for him. He's a good athlete and used to whomp his research assistants in touch football. A sterling fellow."
>
> "I can't think of anyone I'd rather support."

Dr. Pimentel has earned the respect of a broad spectrum of the scientific community for the excellence of his research and for his commitment to science education. We believe his appointment presages new and better days for the National Science Foundation and a return to its role of leadership in improving the nation's science education and research efforts.

Sincerely yours,

Jon W. Fuller
President

JWF/kdh
cc: The Honorable Edward M. Kennedy
enclosure: "New NSF deputy head stresses basic research," C&EN, September 5, 1977.

NATIONAL SCIENCE TEACHERS ASSOCIATION

AN AFFILIATE OF
THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

1742 CONNECTICUT AVENUE, N.W. WASHINGTON, D.C. 20009 · TELEPHONE: AREA CODE 202 • 265-4150

Robert L. Silber — *Executive Director*

September 22, 1977

Honorable Senator Harrison Williams
Sub Committee on Health and Scientific Research
Dirksen Senate Office Building
Room 352
Washington, D. C. 20510

Dear Senator Williams:

I am writing in behalf of Dr. F. James Rutherford who is the nominee for appointment as Assistant Director for Science Education of the National Science Foundation and Dr. George C. Pimentel who is the nominee for Deputy Director of the National Science Foundation.

Dr. Rutherford has achieved well deserved prominence in the field of science education as a teacher, eminent leader, and as a fine administrator. He has directed significant programs for improving science education at the elementary, junior high school, high school, and university levels. He is respected in the field of Physics as a writer and teacher. He would be a great asset to the National Science Foundation, would provide the kind of leadership needed at this critical time, and would have substantial support from the science education community.

Dr. Pimentel is an outstanding researcher in the field of Chemistry. He has made significant contributions in his field and is greatly respected by scientists the world over. He has received numerous awards for his scientific contributions. Additionally, in a critical period when a much needed revised curriculum was needed in high school chemistry, Dr. Pimentel left his research to direct the writing and to edit the most widely used chemistry materials in the schools in the 1960's.

I highly endorse both Dr. Rutherford and Dr. Pimentel and urge you, your sub committee and the U. S. Senate to appoint these nominees.

Sincerely,

Robert L. Silber

RLS:EP

Robert L. Silber, Executive Director

September 23, 1977

Senator Harrison Williams
Chairman, Committee on Human Resources
4230 Dirksen SOB
Washington, D. C. 20510

The American Association of State Colleges and Universities comprised of 324 member institutions supports confirmation of Dr. James Rutherford as Assistant Director for Science Education of the National Science Foundation.

John A. Marvel
President, American Association
of State Colleges and Universities
President, State Colleges and Universit
Consortium of Colorado

Walter Waetjen
Chairman, AASCU Committee on
NSF Liaison
President, Cleveland State
University, Ohio

Allan W. Ostar
Executive Director
American Association of State
Colleges and Universities

cc: Anne Strauss
Committee on Human Resources

THE INDEPENDENT COLLEGES OFFICE

THE GREAT LAKES COLLEGES ASSOCIATION

September 23, 1977

The Honorable Edward M. Kennedy
Chairman
Subcommittee on Health and Scientific
Research
Senate Committee on Human Resources
431 Russell Senate Office Building
Washington, D.C. 20510

Dear Senator Kennedy:

In response to your request, enclosed are some questions which the Great Lakes Colleges Association suggests might be directed to F. James Rutherford and George C. Pimentel during their confirmation hearings September 27.

We thank you for this opportunity to participate in a process which directly affects the future of science education in our colleges and throughout the Nation.

Sincerely,

Ida Wallace
Director

IW/kdh

enclosure: Suggested Questions

Suggested Questions for Dr. F. James Rutherford:

1. For the past five or six years, NSF has had no long-range plan for science education and budget requests for programs show no sustained pattern. After your "settling-in" period, will you prepare a long-range plan for the Education Directorate?

2. In the past two years, morale reports for the Science Education Directorate staff have been very low. What plans to you have for raising your staff's morale? Do you plan any program of professional development for them?

Suggested Questions for Dr. George C. Pimentel:

1. Do you see it the business of the Foundation to produce science manpower as well as to encourage research? What is the role of science education in producing science manpower?

2. Do you see the organizational structure of NSF as insuring science education equitable treatment with research? Does the physical isolation of the education directorate preclude its participation in the mainstream of NSF activity?

Independent Colleges Office
Great Lakes Colleges Association
September 23, 1977

GLCA

GREAT LAKES COLLEGES ASSOCIATION 220 COLLINGWOOD, SUITE 240, ANN ARBOR, MICHIGAN 48103 (313) 761-4833

September 23, 1977

The Honorable Harrison A. Williams
Chairman
Senate Committee on Human Resources
352 Russell Senate Office Building
Washington, D.C. 20510

Dear Senator Williams:

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"There's no question about his competence. He is smart, innovative and a helluva good scientist."

"Pimentel is a man who has excelled in research but has also been an outstanding educator and will be understanding of our institutions."

"I have the highest regard for him. He's a good athlete and used to whomp his research assistants in touch football. A sterling fellow."

"I can't think of anyone I'd rather support."

Dr. Pimentel has earned the respect of a broad spectrum of the scientific community for the excellence of his research and for his commitment to science education. We believe his appointment presages new and better days for the National Science Foundation and a return to its role of leadership in improving the nation's science education and research efforts.

Sincerely yours,

Jon W. Fuller
President

JWF/kdh
cc: The Honorable Edward M. Kennedy
enclosure: "New NSF deputy head stresses basic research," C&EN, September 5, 1977.

98-146 108

New NSF deputy head stresses basic research

"My most immediate first task will be to find out what the goals and aims of the director [Dr. Richard C. Atkinson] are and to support him in every way I can. That's what I consider the deputy director is for," Dr. George C. Pimentel comments following his nomination to the number two post at the National Science Foundation (C&EN, Aug. 29, page 15). President Carter has recommended his choice to Congress and it now awaits Senate confirmation.

Not surprisingly, Pimentel believes that he can contribute in the area of science education. "It may well be that we will need to mount some new programs to meet the educational problems of today," he says. "As I see it, the scientific education challenge is to reach people who now do not take high school chemistry and to see to it that they have an opportunity to gain some scientific literacy."

One subject that Pimentel feels strongly about is what he views as the diminishing appreciation of the importance of fundamental research. "That's one of the main reasons I took the job. I feel that people who have been engaged in scientific activities and teaching, like myself, have to do their part to persuade our representatives and the people at large that fundamental research is as important to the future of the country as looking at the immediate societal problems we face today. We live in an era where short-term results are put in very high value and mission-oriented supportive research is being pushed strongly. Questions are being raised about the usefulness of long-range research. I will use every opportunity while in Washington to try to persuade people that we need to maintain the reservoir of fundamental information that ultimately will be put to work to solve

Pimentel: research is vital to future

problems, and that the problems of the future and what knowledge will be useful just can't be predicted. If we starve our fundamental research programs we will pay for it later."

Pimentel, 55, professor of chemistry at the University of California, Berkeley, is a scientist of international repute. He led the team at Berkeley that designed and built the compact and highly sensitive infrared spectrometers that were launched on the Mariner VI and VII space probes and transmitted details to earth of the Martian atmosphere and surface composition. Other accomplishments of which he is proud are the development of the first chemically pumped laser in 1964, and development of the matrix isolation technique that allows "freezing" of highly reactive transient chemical species so they may be studied at leisure. But Pimentel also is deeply committed to education, and his freshman chemistry courses at Berkeley are among the most popular on campus. ⊏

The CHAIRMAN. The committee stands adjourned.
[The committee adjourned at 11 : 05 a.m.]

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