Letters

NASA and Education

The 22 November issue contained an article under "News and Comment" on NASA and education. Acknowledging with gratitude its complimentary statements regarding NASA and respecting the reporter's objectives, we feel obligated to correct certain important inaccuracies and to clarify somewhat the purpose of the NASA predoctoral training program.

The article has identified the NASA predoctoral training program specifically with the broad problem of federal aid to education and the general augmentation of science education. That such written or spoken comments, through a misunderstanding of the originator or through his choice of words, can create suspicion and bias against the program is quite evident. We are not now nor do we intend to become involved in the general problem of federal aid to education within the context of current legislation on the subject. NASA's training program is designed to assist in the training of some of the scientists and engineers which the space program will require in future years if this agency's mission is to be accomplished.

Reference is made to the report of the President's Science Advisory Committee which recommends a goal of 7500 Ph.D.'s per year by 1970 and to NASA's expectation that 4000 graduate students will eventually be in its own program at one time. This is indeed our desire and expectation. However, it should be pointed out that the NASA training grants are made for 3 years and that we are striving for a level of 4000 students in training in order to achieve an output of 1000 Ph.D.'s per year. Since about 3400 doctorates were awarded in EMP fields in 1962, the goal of 7500 requires an increase in output of about 4000 Ph.D.'s per year, of which NASA hopes to provide about one-fourth. It seems, therefore, unlikely that NASA will be the largest single contributing agency by 1970.

A specific inaccuracy in the article is in reference to the amounts of money awarded. The NASA program was identified as being one of the "most lucrative to be had from the federal government." The stipend is fixed at $2400 per year. NASA also provides an additional student allowance for dependents and escalation, to be administered in accordance with university policy, but in no case may it exceed $1000 per student per year. The NSF Cooperative Graduate Fellowship program is equally lucrative since it provides for an annual stipend of $2400 per year and the participating institution may, at its discretion, supplement the fellow's stipend at a rate not to exceed $1000 for a fellow on 12-month tenure. Other examples of so-called "lucrative" fellowships may be found on page 18 of House Document No. 159. The statement that NASA's institutional allowance averaged $4000 per student is completely unfounded. Grants made in fiscal 1963 included an institutional allowance averaging $2508 per student per year.

Another statement referred to the development of a "political constituency" and an "end-run" around congressional suspicions of federal aid to education. Whether or not it was intended, we cannot refrain from suggesting that unwarranted damage can be and perhaps has been done to an important program by such a casual statement.

The last paragraph referred to Representative Fountain's contention that grant's should be awarded only to the best and that the criterion should be excellence—not acceptability. It is agreed that excellence should always be a primary governing criterion. We in NASA, faced with accelerating advances in science and technology, must make every effort to broaden the base of scientific resources available to the nation's space programs. Scientific and engineering manpower, as represented by Ph.D.'s trained in space-related fields, is one of our resources which may face serious depletion if training opportunities are curtailed. It is well known that approximately 150 colleges and universities in the United States grant doctorates in space-related sciences or technology. NASA, therefore, takes the position that all available capability must be utilized commensurate with acceptable standards of excellence. It unfortunately is true that the greatest capacity for producing Ph.D.'s at an increased rate is concentrated in a small number of the larger institutions. However, we believe that if we were to direct all of our attention to the giants and perpetuate the situation, with full knowledge that many of the smaller schools have the capability and are eager to make excellent contributions to the advancement of this nation's knowledge of space, we would be derelict in discharging our responsibilities.

We are anxious that the scientific community be fully informed concerning this training program. The reporting which is necessary to effect this communication must be both objective and accurate.

HUGH L. DRYDEN
National Aeronautics and Space Administration, Washington, D.C.

Government and Science: How Science Policy Is Developed

Your recent editorial (*Science*, 22 Nov. 1963) and speech make clear that there is a need for a better understanding of the role of the President's Science Adviser and the way in which science is administered in our government. I shall try to light a small candle rather than curse the darkness.

The present mechanisms for developing national science policy must be understood in their historical context. Scientists connected with the development of the atomic bomb and of the applications of science during World War II recognized the fortuitousness of the White House support they received and saw the need for a permanent advisory mechanism near the President and for a permanent mechanism for the civilian support for science. Although they failed in their early efforts to create a direct connection between science and the President, the National Science Foundation provided the basis for federal support of science. A policy officer was established close to the Secretary of Defense to evaluate numerous questions of weapon technology, but the importance of science and technology was ignored in older departments like the Department of Commerce and the

Department of Interior. Here, scientific agencies, like the National Bureau of Standards and the Bureau of Mines, reported to inexpert policy officers with other responsibilities. The President's science advice flowed mainly through an office having responsibility for emergency planning, the Office of Defense Mobilization.

The shock of Sputnik awakened the nation to the central importance of science, and science policies became the direct concern of the President, with the appointment of the first Special Assistant to the President for Science and Technology. James T. Killian developed and expanded the new connections between President Eisenhower and science through a strengthened Advisory Committee and increased the consideration of science in establishing executive policy. The newly recognized importance of science and technology demanded more coordination of the activities of the departments and the independent agencies. A scientific coordinating committee made up of bureau chiefs and laboratory heads already existed within the government. The President followed the advice of a committee headed by Emanuel Piore and transformed the scientific coordinating committee into the Federal Council for Science and Technology. When George B. Kistiakowsky was the President's adviser, the Federal Council assumed broader responsibility for the evaluation as well as the coordination of federal scientific and technical activities.

By now the Science Advisory Committee and the Federal Council for Science and Technology needed help—help to staff committees, help to write reports, help to analyze legislation, and help to deal with political problems. The people to help needed to know or be able to learn quickly how the complex process of decision making actually takes place in the government. This staff had to be able both to combine scientific information with political, economic, and social factors and arrive at a clear formulation of issues—not necessarily a task that should be performed on a full-time basis by creative scientists in the prime of their powers. To paraphrase Clemenceau—science is too important an activity to be left (wholly) to the scientists.

President Kennedy found a Congress anxious to participate more fully in scientific matters and perturbed by the apparent complexity of science and the widely scattered scientific programs. The great diversity of activities called research and development had by now reached a scale that attracted political attention. Congress desired a policy officer of the President who was free to speak candidly.

Many Congressmen believed that a Department of Science, with broad responsibility for science, would be a simple solution to the control of this complex activity and would give to Congress direct access by its usual committee organization. A Congressional subcommittee under Senator Jackson and a committee of the President's Science Advisory Committee, chaired by H. Brooks, recommended instead the establishment of the Office of Science and Technology to evaluate the nation's scientific programs and needs, with a director who would be available to testify before Congress. But this office would not have direct control of the federal scientific program.

Jerome Wiesner became director of the Office of Science and Technology, aided by the staff that had been brought together to support the Federal Council and the President's Scientific Advisory Committee. He began to raise the level of scientific management in the Executive Branch, insisting, where possible, that a policy officer having a background in science be made directly responsible for the scientific and technical activities of the several departments and of the individual agencies. The Federal Council for Science and Technology, chaired by the director of the Office of Science and Technology, could now begin to be the subcabinet for science and technology. It is beginning to face the complex science policy questions involving engineering, economics, politics, and social science that are so important today. Four clearly recognized functions for the science apparatus of the President have thus developed:

1) Providing direct access of the scientific community to the President (President's Scientific Advisory Committee)

2) Advising the President's office on policy matters involving science and technology (President's Science Adviser)

3) Coordinating the decentralized management of science and technology throughout the executive branch (Federal Council for Science and Technology)

4) Critically evaluating the nation's scientific and technical efforts, and the resources needed for them, and providing information about them to the President and to Congress (Office of Science and Technology)

The fact that a single person acts for the President in matters of science confers upon him neither greater nor lesser power than is inherent in the office of the President. The President's science policy depends on advice from an officer who is in contact with the scientific community, who is familiar with the science and technical policy officers of the departments, and who is assisted by a staff of people who help him evaluate the relation of science to the nation's welfare. He is able to help in formulating the President's budget with respect to those matters that might touch upon scientific or technical affairs. Often these budget decisions are concerned with the engineering judgments of what is possible or feasible, with questions that have to do with costs as they relate to benefits of a program. He aids the Bureau of the Budget and thus is the President's science agent in fiscal discussions. This budget is the President's budget and is supported in numerous of committees of Congress by the secretaries of the Cabinet departments and the heads of the independent agencies, and Congress then decides on and allocates the funds, usually without the direct participation of the science adviser.

If each of the several functions of the President's Science Committee were performed by different officers, the agencies in the departments of the Executive branch and Congress would have additional people to contact and the President would need a coordinator for his science policies. (Heaven help us keep Parkinson's law from applying to science!)

It is apparent that the science advisers to the President during the last several years have (i) strengthened and have made easier the access of civilian scientists to the President; (ii) have raised the level of science in policy making in the several departments and independent agencies; (iii) have been increasingly responsive to Congress with information and advice; (iv) have provided a better relation between science and the other economic, social, and political aspects of national policy, by the use of an increasingly knowledgeable and effective staff; (v) and all the while have resisted those who would seek simple solutions to complex prob-

lems by giving power over technical matters to a single department for scientific and technical activities of the government. These arrangements allow the President and the Bureau of the Budget to become knowledgeable of science questions without removing the technical activities from the agencies whose missions they augment.

Jerome Wiesner and his staff must be judged by what he and his office have accomplished rather than by the weight of reports so commonly used to evaluate professors. He helped the President to open a small path of understanding with the Soviets, encouraged the careful analysis of costs and effectiveness that permitted the Secretary of Defense to re-establish civil control over the military, strengthened the management of science within many of the agencies, and more recently helped make some small steps to connect better the scientific community to the problems of the less-developed nations. He unobtrusively insisted on a proper place for science in the affairs of the nation and gave continued support for free scientific inquiry.

As for me (one of the officers in the agencies whose scientific progress Wiesner is alleged to control), I have found him to be critical, helpful, and insistent that the decisions in the Department of Commerce were ours and not his, and that he served only to help the President and his secretariat. Like President Kennedy, he has insisted not only on the right, but the necessity, to talk to those who are informed and not only to those who, by some quirk of accident, occupy positions of authority.

All of us who have a part in the nation's scientific and technical affairs recognize that there are most serious problems facing the nation and its science and engineering. The technical resources of our country are now clearly limited. We cannot carry out all of the proposals that the scientists and technical people can make. Scientific and technological resources are a major basis for economic development and for national power, and we do not yet know how best to deploy them. The relative roles of private and public participation in the use of science and technology for practical purposes are not clear, nor do we know how to employ fully the fruits of science for the improvement of our society.

All of us seek to attract bright, intelligent, wise, and effective people into government service. Usually, scientists serving the nation full time find their careers interrupted and their pay far too low. Technical industrial leaders are frequently not considered because of concern for potential conflicts of interest. Academic people often are not fully prepared for the pragmatic problems faced by those involved in formulating scientific policy. Finally, many are unwilling to face the realities of American political life necessary to serving their government. There are others who would like to maintain their scientific, technical, industrial, or academic positions while influencing national policy. They would like the authority without the responsibility.

In these difficult times, this nation needs all of those who are willing to give of their time and effort to study, to understand, and to make science more fully serve humanity.

J. HERBERT HOLLOMON
U.S. Department of Commerce, Washington, D.C. 20230

Wiesner's Public Service

The editorial in the issue of 22 November [*Science* **142**, 1025 (1963)] suggests that when the President's science adviser retires from office, tradition requires that "comment at this time should consist of 'fulsome' praise of his policies and accomplishments." It seems to me that Wiesner's retirement does not call for either "fulsome" praise or "fulsome" criticism but for a dignified, judicious, reasonably sympathetic, and constructively critical appraisal of his tenure, one that will be worthy of the official journal of the AAAS. I hope that such a report may yet appear in the pages of *Science*.

My own opinion is that Wiesner deserves the gratitude and admiration of his fellow scientists for 3 years of devoted public service in their behalf while necessarily foregoing his own scientific work. As for his effectiveness in office, I can cite the obviously important part he played in helping to bring about the ban on atmospheric testing of nuclear weapons, which ranks as one of the most hopeful steps taken toward world peace since the end of World War II. I also recall two instances in which he used the full influence of his office to protect observational astronomy from possible permanent damage—from the orbiting of dipoles or "needles" in one instance, and in the other from the encroachment of man-made interference on radio-astronomy frequencies. In both cases Wiesner and his staff responded to the petitions of astronomers with sympathy and understanding, and he acted with great courage to safeguard the interests of our science. He and his associates on the PSAC are primarily responsible for the publicly announced policy of the United States government to forego space experiments that are harmful to science.

These few examples, and many others which are all matters of public record, in my judgment refute the assertion that "After almost 3 years in which Wiesner has participated in countless decisions, there is little in the public domain to indicate the quality of his judgments or actions."

I should think that communications like this one belong more properly in the Letters section than on the editorial page.

LEO GOLDBERG
Harvard College Observatory, Cambridge 38, Massachusetts

Science as a Tail to NASA's Kite

Rosa [*Science* **142**, 914 (1963)] is not the first to say, in effect, that we should support NASA research because of the scientific "fallout" accruing to other scientific disciplines. But if this accrual is so important, why not directly support research in "geophysics, . . . geomagnetics, . . . solar physics, astrophysics, and solar system astronomy"? Why waste money through a middleman? Rosa's inclusion of molecular biology among the beneficiaries of space research is particularly ludicrous; the question of spores in space is an interesting one, but hardly fundamental to molecular biology, and surely not to be included among any logical reasons for massive support of NASA.

His argument that "space has stimulated interest in science . . . more than any other scientific development in modern times" might be acceptable if we did not know the tremendous public-relations build-up given the whole enterprise; witness the successive astronaut launchings. The interest was built up by the glamor boys, and I dare say to the detriment of the rest of scientific endeavor.

Rosa reasons that "space offers mankind an opportunity to channel deep,