see, and to act upon, deficiencies in the executive's formulation and coordination of R&D policies than to remedy its own deficiencies. There is a clear need for improved mechanisms within Congress, comparable to those which have been developed in recent years within the executive, for handling the flow of scientific programs and budgets on a basis that is broadly consistent and campatible with the national interest. The appointment of a new unit in the Legislative Reference Service of the Library of Congress to provide information on scientific and technological programs and policies, the continuing work of the Daddario subcommittee, and the establishment of the new permanent Subcommittee on Research and Technical Programs of the House Committee on Government Operations, under the chairmanship of Representative Henry Reuss of Wisconsin, indicate a recognition of the problem. Is it too sanguine to foresee further Congressional steps to define national rather than sectional goals for science and technology and to enlarge the authority of Congress as a whole in the making of science policies?

Summary

The problems of government science policy I have noted are not exactly new, but each has, I believe, acquired a new degree of urgency from the pressure of events: How much should be spent on basic research and how much on civilian technology? How can reasonable allocations be made among various fields of science? Who is to make these allocations, in the executive and in Congress? The degree to which we can, by objective research and perceptive analysis, accommodate the accidents of history and politics to the changing needs of science, industry, and society will determine the degree to which we can serve not the interests of those groups and individuals (both scientists and politicians) who happen to be in positions of power, but the present needs of the nation.

References and Notes

1. A. Waterman, Director's Statement, in *Nat. Sci. Found. Ann. Rept.* **8**, xii (1958); *Science* **147**, 16 (1965). In contrast, John Jewkes argues that "the overwhelming mass of scientific thought and observation in the Western world was never designed to bring, has not brought, and is highly unlikely ever to bring the slightest improvement in material standards of living" [*Economic Journal* **70**, 14 (Mar. 1960)].
2. See R. Sachs, H. Primakoff, H. A. Bethe, and J. R. Oppenheimer, all in *The Nature of Matter: Purposes of High Energy Physics*, L. C. L. Yuan, Ed. (Brookhaven National Laboratory, Upton, N.Y., Jan. 1965); see also *Science* **147**, 1548 (1965).
3. From letter, dated 27 March 1964, from Donald Hornig to Senator John Pastore, in *High Energy Physics Program* (Joint Committee on Atomic Energy, Feb. 1965), p. 57.
4. *Basic Research and National Goals* (Committee on Science and Astronautics, House of Representatives, Mar. 1965), p. 1.
5. *Basic Research and National Goals*, report of the Committee on Science and Public Policy, National Academy of Sciences (U.S. Government Printing Office, Washington, D.C., April 1965).
6. L. Haworth, "Director's statement," in *Nat. Sci. Found. Ann. Rept.* **14**, xxv (1964).

News and Comment

Defector's Odyssey: Personal Look at Soviet-Bloc Science Provided by High-Ranking German Physicist

The Senate Internal Security Subcommittee last week issued one of the more bizarre prose productions of the Cold War, a 94-page document entitled "Nuclear Scientist Defects to United States."*

The work opens with a foreword in which Senator James O. Eastland (D–Miss.) says he feels the testimony therein "will be of considerable interest to Members of the Senate and to the scientific community and all thoughtful Americans." It closes with an index headed by the generous notation that the "subcommittee attaches no significance to the mere fact of the appearance of the name of an individual or an organization in this index." And between these two statements lies approximately 4 hours and 30 minutes of a closed-session colloquy between Committee Counsel J. G. Sourwine and Heinz Barwich, an East German who was director of the Institute for Nuclear Research, in Rossendorf, East Germany, and former deputy director of the Institute for Nuclear Research, at Dubna, near Moscow.

When Barwich defected last September, while attending the U.N. Atoms for Peace conference in Geneva, the Associated Press reported that "Western sources considered him the greatest prize in two decades of nuclear intrigue." And the implication was conveyed that to top the Barwich coup, the Russians would have to pick up at least two AEC Commissioners and a member of the Joint Chiefs of Staff. The spooky past of East-West intrigue, nuclear and otherwise, impels the outsider to caution in judging security matters that governments select for public display. But on the basis of the published Barwich-Sourwine dialogue, and other information, it would appear that if Barwich is the "greatest prize in two decades of nuclear intrigue," the cost-effectiveness ratio of this intrigue is appalling. Barwich himself, though occupying a highly important place in the early stages of the Soviet weapon program, states flatly that his association with secret research ended in 1952, and that thereafter he was engaged in work that was aboveboard and generally known to the West.

One measure of the Soviet evaluation of his knowledge may be seen in the fact that, though Barwich revealed his political doubts by openly opposing a Soviet position at the 1960 Pugwash meeting, he was still permitted to travel outside the Soviet bloc. The Russians, who reportedly keep many of their top military and space researchers out of sight of the West, apparently didn't see much hazard in letting him move about. One reason may have been that his present wife and two children were residing in East Germany, but they, too, managed to make it to the West, although, according to Barwich, two children by an earlier marriage were caught and imprisoned. In any case, the Barwich tale, taken at face value, seems to have little if any military significance, but it does offer a sad chronicle of a talented and obviously ambitious scientist seeking to make his way in an at-

* Available for 30 cents, U.S. Government Printing Office, Washington, D.C. 20402.

mosphere in which his abilities and professional values were being subordinated to political purposes.

As related by Barwich to the Senate subcommittee, the Nazis deferred him from military service during World War II so that he could work on proximity fuses. Three months after the war ended, he was at Sukhumi, on the Black Sea, helping the Russians build their atom bomb. In response to the question "Did you go to Russia voluntarily or were you forced to go?" Barwich answered, "I went voluntarily." But it should be noted that many of his replies suggest a less-than-perfect understanding of English and that often his answers were not explored to determine whether he understood the questions and was making himself understood. His task at Sukhumi involved development of a large-scale isotope-separation technique, an area in which he had received his doctoral degree in Berlin in the early 1930's. Barwich stated that "We were not the most important [Soviet] laboratory" working on the separation problem, but the Russians apparently were pleased with his efforts. They awarded him a Stalin Prize, which, in the grim early postwar days, was no small token of appreciation. "When you get a Stalin Prize," Barwich told the subcommittee, "you get a medal of gold or silver, and then you get a document, and then you get a lot of money . . . $10,000 or $20,000 in present money. . . . You can get your children into every school you want without money. . . . You can travel on the railway and in airplanes without money. It was at this time a big advantage for Stalin prizewinners."

End of Secrecy

In 1952, he told the subcommittee, virtually all secrecy was dropped at Sukhumi, but prior to that Barwich and his colleagues were bound by regulations that would have made some old-time AEC security officers salivate with envy. On the physical control of paper, Barwich related that "you went into this room and asked for 10 sheets or whatever you wanted. You received exactly the number of sheets you requested and no more. . . . And when you used the paper, you returned it so that each page was accounted for. The paper was then destroyed."

"And if you didn't account for all the pieces you had you were in trouble?," the committee counsel asked.

"You had trouble," replied Barwich. ". . . this will mean big trouble, of course. The man would say, 'I give 10, I have only 9. Barwich has one paper.' Then they would invite me for a chat. We had a special general . . . and this general had to decide what to do with this man—announce it in Moscow or clear it up locally, so it may be said to him, 'What did you do with the paper?' And when he was satisfied, 'You do it once more in your life and then I cannot save you from jail,' or something like that."

On the basis of what happened in 1955, it may be presumed that both the Russians and the East Germans had come to regard Barwich as politically trustworthy and scientifically and administratively competent. At that time, the director of the Institute for Nuclear Research in Rossendorf defected to the West, because, Barwich told the subcommittee, "he was so afraid of the danger of failure in building the first nuclear reactor in Germany. . . ." Barwich was appointed to succeed him, and he held the Rossendorf directorship for 10 years, including the 1961–64 period when he was deputy director of Dubna.

Rossendorf Facilities

As described by Barwich, Rossendorf was engaged exclusively in nonclassified research, principally directed toward nuclear power development; it had a staff of 870, including approximately 170 research scientists, and its equipment included a 120-centimeter cyclotron, two small reactors, computing facilities, and isotope production, metallurgical, and radiochemical laboratories. What it did not have—to Barwich's great disillusionment—was political and financial support for the development of nuclear power, and freedom for the institute director to manage scientific and administrative matters according to his own professional judgment.

Barwich relates that when he realized that the Russians were not inclined to let the East Germans develop and build reactors, he complained to East German President Walter Ulbricht, who carried the complaint to Nikita Khrushchev.

Khrushchev's response, according to Barwich, was: "You must not believe all these things which the scientists say because they always want more than they can get—they are never satisfied." Conditions didn't improve at Rossendorf, Barwich continued, but as a consequence of the complaint the Soviets took steps to have the Dubna center work more closely with eastern bloc laboratories.

As for further tribulations, Barwich related that an "important restriction in Communist countries consists of party control of the choice of your co-workers. By charter of the institute the director has to decide whom he wants to take; but in practice he must agree with 'leader of cadres,' party, and trade union representatives. So it turns out that the most difficult thing is to get rid of a third-class co-worker —independent of his connection to politics, and to get a very good young scientist who perhaps does not have the right political 'character.' "

No "Lysenkoism" in Physics

Barwich said he encountered no "Lysenkoism" in physics, but he found other reasons for disillusionment with East German science and politics. The central committee of the East German Communist Party "had big ambitions to build atomic power plants very quickly, but they did not plan in detail," he said. "They didn't realize what was needed, the difficulties, what was required for investments. So they effected pressure upon me and my institute sometimes to make some foolish work which was not in reality fruitful. . . . So I had suffered a little, everybody suffers more or less from these directions. . . . The scientists and engineers are not contented, not satisfied by this, and it is only a matter of time before they will see the truth."

The dawning of the "truth" apparently coincided with an invitation to attend the 1960 Pugwash meeting in Moscow. There, Barwich told the subcommittee, he worked behind the scenes to oppose the Soviet delegation, and actually voted against a Soviet draft proposal on disarmament procedures. Subsequently, his Pugwash role was reduced from delegate to "below an observer." The Pugwash experience and the erection of the Berlin Wall in 1961 further fed his disillusionment, while, at the same time, Barwich continued, he became increasingly interested in "taking part in society in political questions *à la* Pugwash."

Why did he defect? Barwich's lack of facility with English somewhat obscures his explanation, but, in general, the motivations come through:

"The principal factor was that I couldn't achieve my goals which I had before me (which were aside from the pure scientific work, the pure money-making, the pure material side of life),

and these were related to my children, too. My goal is connected with my children. . . . I have tried many things before my decision. . . . I came from Russia as a good friend of the Soviet Union. And they took me for a good friend . . . and as a good friend of the Soviet Union and as a so-called progressive scientist and big manager of science, I was invited to many meetings and conferences which I was not very happy about because I don't like to speak in a manner half the truth and half the lie. . . . Before the wall there was always the possibility of escaping, so scientists were permitted some little bit of freedom, a little bit of liberalization and a little opportunity to associate with the West, to go to the West on journeys or take part in scientific meetings and so on. . . . So life became very, very disagreeable [after the wall], there was no exchange of ideas, no discussion, all these things stopped.

"So after the wall, I discussed the problems with my wife—already two years ago, while in Moscow, we had discussed the idea of leaving for this and for the sake of the children."

Barwich related that they delayed their defection because the children of his first marriage were in East Germany. But eventually they decided to break with the East. Of the children who remained behind he says, "The children are not so old, they are young people, and they will survive and they will get some solution in the future."

Barwich's movements since his defection have been closely guarded. He appeared before the subcommittee in December, and in the course of his testimony made reference to a recent visit to Brookhaven National Laboratory. At present, it is understood that he is in West Germany and may take an academic position there.

—D. S. GREENBERG

Congress: Subcommittee Surveys Effects of Federally Supported Research on Higher Education

The question of the extent to which federal support of research has harmed as well as helped American institutions of higher education is not a new one inside Congress or out, but a House subcommittee has lately been giving the subject its most intensive scrutiny to date on Capitol Hill.

The initiative came from the House Government Operations Committee's new subcommittee on research and technical programs chaired by Representative Henry S. Reuss (D–Wis.). This subcommittee, established in February, is the latest among several groups formed in the House to consider the conduct and implications of the $15-billion-plus-a-year federal research and development effort.

Reuss's subcommittee based its investigation on 3 days of hearings in mid-June and a canvass by letter of some 300 "selected faculty members in a number of fields, as well as university administrators and other distinguished citizens." About 170 replies were received in time to allow the subcommittee staff to put together a compendium intended to provide a cross section of opinion and to publish it as a committee print in advance of the hearings.* About half the 170 responses are represented either by full letters or excerpts. There are plans for including later replies in the published record of the hearings.

Answers to a Questionnaire

The subcommittee's "poll" was based on questions grouped under five major headings (see box) and, according to the introduction to the committee print, the questions were "compiled from extensive literature which has appeared in the last few years. They seemed to the committee to summarize the salient aspects of the problem."

The questions are clearly not the sort that can very usefully be answered yes or no. Because of the broad focus of the questions and the variety of viewpoints expressed, the results of hearings and the canvass are inevitably inconclusive. But the subcommittee has made a solid contribution by giving serious attention to a number of interrelated questions which have been vexing people in higher education since the rise of Big Science. And the record of the investigation will be a useful one not least because the net was cast wider in the academic community than usual and brought in a number of people besides those who by virtue of achievement or position are, ex cathedra, perennial witnesses before Congress.

Both the letters and the testimony in the hearings reflect a consensus that the wartime marriage between government and the universities is, for better or worse, permanent; in general, they support the judgment of the Carnegie survey of 2 years ago that, on balance, the relationship is beneficial to the universities.

This is not to say that on a number of counts there were not expressions of serious concern. The quality of teaching undergraduates are getting was the subject of fairly widespread although certainly not universal worry. Sharpest concern was directed to the independent liberal-arts colleges, which are seen as suffering, indirectly at least, from emphasis on research in the universities.

Most pessimistic perhaps was one unnamed member of the faculty of the Columbia University graduate school of business who said: "Small liberal arts colleges are threatened not (so much) by federal grants as by economics of scale in higher education, which raises the question whether these institutions are viable."

Much more typical was a view that liberal arts colleges must and can do more to create an atmosphere in which research—particularly in the sciences—is an integral part of education, as has been successfully done in a number of the "prestige" colleges.

It was generally recognized that the key to the problem is faculty and that able young scholars in fast-moving fields will not emigrate to the colleges and stay there if such action forecloses their chances for a research career. Most of the suggestions for mitigating the isolation of the researcher in the liberal arts colleges implied establishment of new or modified federal programs as well as cooperative programs among institutions. The main recommendations were for arrangements to lighten the characteristically heavy teaching loads in the colleges, to make it easier for college faculty to use the library and laboratory facilities of the universities and national laboratories, and to enable college scholars to work periodically for sustained periods with leading men in their fields.

As for undergraduate education in the universities, it was acknowledged that teaching may be left largely in the hands of graduate teaching assistants. This can be unsatisfactory, but a fairly strong segment of opinion held that this is not necessarily a bad thing. One who expressed this latter view without sounding like Pangloss was C. H. Braden, a professor of physics at Georgia Tech.

"Perhaps the principal consideration," wrote Braden, "is the increasingly large fraction of the college age population that attends college. This, cou-

* *Conflicts Between the Federal Research Programs and the Nation's Goals for Higher Education,* available from the Committee on Government Operations, House of Representatives, Washington, D.C.