A corollary of this is that the advice cannot simply be given to the top levels if favorable decision and effective implementation of advice is desired. Consider the case of a high level decisionmaker accepting the recommendation of an advisory group and making a "policy" decision designed to implement the advice. Unless the subordinates carry out the decision effectively the whole intent can be defeated. Comprehension of the basis for the decision reached at the higher level can be a vital factor in winning the consent and enthusiasm of those who must execute the decision and, in doing so, make a myriad of other decisions which can determine the success or failure of the original decision. It follows therefore that it is often desirable to communicate the research advice to the working levels of an organization as well as to the higher policy levels.

Summary

In summary then, the growing call from government for the universities to do applied research in the civilian sector has many disturbing elements. It asks the university to provide more policy advice. In addition, it calls upon the university to become an advocate for that policy research. One can hardly be a part of the university tradition in this country without being initially appalled. Yet the demand is clearly there and it is hard to disagree with Perkins when he says, "The University—as the most sophisticated and, let us hope, independent agency now at work advancing, transmitting and applying knowledge—has come too far to retreat before what may be its finest hour" (*8*, p. 24).

References and Notes

1. I. Kristol, *Fortune* **76**, 90 (1967).
2. T. H. White, *Life* **62**, 23 (1968).
2a. The material for this paper is taken in part from a broader study done for the Council on Economic Growth, Technology, and Public Policy of the Committee on Institutional Cooperation.
3. R. E. Lapp, lecture to seminar on science and public policy at Purdue University, 24 February 1967.
4. Refer to report of the Committee on the Economic Impact of Defense and Disarmament; chaired by G. Ackley, July 1965 (U.S. Government Printing Office, Washington, D.C., 1965), pp. 16–23.
5. U.S. Congress, House Select Committee on Government Research, *National Goals and Policies*, No. 10, 88th Congress, 2nd Session (U.S. Government Printing Office, Washington, D.C., 1965).
6. U.S. Congress, House Subcommittee on Science, Research, and Development of the Committee on Science and Astronautics, *Inquiries, Legislation, Policy Studies Re: Science and Technology*, 2nd Progress Report, 89th Congress, 2nd Session, 1966 (U.S. Government Printing Office, Washington, D.C., 1966), p. 24.
7. U.S. Congress, Senate Subcommittee on Employment, Manpower, and Poverty of the Committee on Labor and Public Welfare, *The Impact of Federal Research and Development Policies upon Scientific and Technical Manpower*, 89th Congress, 2nd Session, 1966 (U.S. Government Printing Office, Washington, D.C., 1966).
8. J. A. Perkins, *The University in Transition* (Princeton Univ. Press, Princeton, N.J., 1966).
9. Staff Study for the U.S. Congress, House Research and Technical Programs Subcommittee of the Committee on Government Operations, *The Use of Social Research in Federal Domestic Programs*, Part I, 90th Congress, 1st Session, 1967 (U.S. Government Printing Office, Washington, D.C., 1967).
10. Statement of L. Haworth before U.S. Congress, Senate Subcommittee on Government Research of the Committee on Government Operations, *Hearings: National Foundation for Social Sciences*, 90th Congress, 1st Session (U.S. Government Printing Office, Washington, D.C., 1967).
11. U.S. Congress, House Committee on Government Operations, *Federal Research and Development Programs*, 34th Report, 89th Congress, 2nd Session, 1966 (U.S. Government Printing Office, Washington, D.C., 1966), p. 10.
12. C. Kerr, *The Uses of the University* (Harvard University Press, Cambridge, Mass., 1963).
13. B. R. Smith, *The RAND Corporation* (Harvard University Press, Cambridge, Mass., 1966).
14. H. B. Wells, "A case study of interinstitutional cooperation," *Educ. Rec.* **48**, 355 (1967); also see (*8*), pp. 63–90; and B. R. Keenan, "The Midwest's CIC: experiment in regional cooperation," *Public Admin. Rev.* **23**, 40 (1963).
15. C. Y. Glock, in *Studies in the Utilization of Behavioral Science* (Institute for Communications Research, Stanford University, 1961), vol. 1, p. 7; also quoted in (*13*, p. 216).

NEWS AND COMMENT

CBW: British Protests Grow about Porton Center

London. Criticism of government policy on chemical and biological warfare (CBW) in Britain has recently begun to approach in intensity the British protest against nuclear arms policy in the period before the test ban treaty.

Last week the government announced two moves which are interpreted here as direct responses to the protests. First, the defense ministry said it would open its microbiological establishment to the public for 1 day next fall or early next year. The open day is obviously meant to allay anxieties by stressing the center's activities in preventive medicine and basic research. Then the Foreign Office announced that Britain will seek a new international convention to supplant the Geneva Protocol of 1925 which forbids use of poison gas, but has become something of an anachronism because of the development of new chemical agents and biological weapons. Protestors greeted the government declarations not so much as victories as indications that further changes are possible.

Action by students and by scientists, questions in Parliament, and a redirection of activities by peace groups have all contributed to the rise in pressure. There is no concerted campaign; the aims of the critics differ. On one flank are those who ask simply that secrecy be lifted from a government research program which is avowedly defensive. On the other are those who, usually from pacifist conviction, are deeply suspicious of any research related to CBW and are now seeking more information. The effect has been to bring about the most open public discussion of CBW to date.

The first of a recent series of incidents which brought CBW into the news occurred at the new Essex University when students prevented a senior scientist from the ministry of defense's chemical research establishment at Porton Down from addressing the university chemical society. The same man was later the target of a similar demonstration at Birmingham University.

In a noisy confrontation at Essex, students seemed mainly interested in questioning the Porton scientists about the CS riot control gas (a more toxic tear gas) which was developed at Porton and used by the United States in Vietnam and by French security forces in the Paris riots. At both Essex and Birmingham students appeared tactically to be taking a page from the book of American student action against campus recruiters for Dow Chemical, manufacturers of napalm. But at Birmingham, students and faculty went on

to demand information on whether research at the university could be used for CBW purposes. British students are in an increasingly militant mood and, in looking for issues, there is no doubt that they find the question of research sponsored by the military particularly provocative.

The student appetite for information was whetted on 26 May when the Sunday *Observer* published a front page story under the headline "Biological warfare: Dons named," in which institutions carrying out research for the chemical and biological establishments at Porton were listed. As a source the story gave the testimony of the two establishment directors before the House of Commons select committee on science and technology. Particulars of the contracts were not given the committee, but reporters filled in some of the names and details by scanning university records and talking to scientists.

Since the report of the committee visit had not been published, the Speaker of the Commons promptly ruled that a question of parliamentary privilege was involved and the matter was referred to the committee on privilege. This committee has broad if seldom exercised powers and the case could conceivably lead to fines or even imprisonment for the journalists involved and disciplinary action for any member of the House who released information.

In the same week a dozen leading scientists, including three Nobel prize winners, Maurice Wilkins, C. F. Powell, and F. Sanger, associated themselves with a letter to the Prime Minister asking that the microbiological establishment at Porton be declassified and transferred to the Ministry of Health. This was the latest in a series of requests that control of Porton be shifted either to the Health Ministry or to the Medical Research Council. The last official response to such suggestions was on 31 May in the House of Lords when the government spokesman said that such proposals had been "considered more than once but the change has been deemed inappropriate."

The scientists take the view that the best way to affirm that Porton research is for defensive purposes is to remove the wraps of secrecy. There is little doubt that some also are disturbed by the workings of a cooperative agreement under which Britain exchanges information relevant to CBW with Canada, Australia, and the United States.

In the last week in May also, formation of an Anti-Chemical and Biological Warfare Group was announced at a meeting attended by members of several British peace organizations including the Campaign for Nuclear Disarmament (CND). The initiative for the anti-CBW group seems to have come from a Devon housewife, Mrs. Elizabeth Compton, who organized a local movement when she grew alarmed at reports that the Army Research Establishment at nearby Nancekuke, Cornwall, was manufacturing CS gas and was being used as a testing station for CBW agents and equipment. Mrs. Compton says her aim is to find out what is going on and how it is likely to affect those living in the area. Since Devon and Cornwall are national holiday resorts, she could expect the same sort of sympathy which might be generated in the United States by a report that nerve gas was being tested on Cape Cod.

The first major peace group protest against CBW occurred on the recent bank-holiday weekend when a Christian CND group held a very nonviolent "vigil" at Porton. A spokesman for the National Peace Council told *Science* that he felt CBW protests were unlikely to take the form of mass demonstrations, at least in the near

AEC Honors French Scientists

Atomic Energy Commission chairman Glenn T. Seaborg presented French scientists with a check for $35,000 on 11 June for work done almost three decades ago which contributed to the early development of nuclear reactors. Although the monetary award was no doubt appreciated, the main object of the French scientists' quest—the formal recognition by the Atomic Energy Commission of the importance of the work they had done—was fulfilled by the presentation of appropriate citations at a luncheon held in Washington.

Two of the scientists honored, Lew Kowarski, senior scientist at CERN, and Francis Perrin, High Commissioner of France's Commissariat à l'Energie Atomique, attended the ceremony. The other two scientists honored—Frederic Joliot and Hans Halban—are deceased; relatives of Joliot and Halban attended the ceremony to receive the award from Seaborg. Kowarski and the relatives of Joliot and Halban receive $10,000 each; Perrin receives $5,000.

The award ended a 14-year deliberation. In 1954, a request for an award for the French scientists was initiated before the Patent Compensation Board which decides on atomic energy matters for the U.S. government. In his statement at the ceremony, Seaborg pointed out the nature of the contribution which the men had made—beginning with the discovery of artificial radioactivity in 1934 by Joliot and Irene Curie for which they were awarded the Nobel Prize in chemistry. Halban, Joliot, and Kowarski published the first report of neutron emission in the fission process and the three, along with Perrin, conducted experiments investigating the possibility of a divergent chain reaction in a homogeneous mixture of uranium oxide and light water. Their experiments with heavy water were interrupted by the 1940 invasion of France, at which time Halban and Kowarski were successful in escaping to England with the 180 liters of heavy water which composed the world's principal supply. A few months after their dramatic escape, Halban and Kowarski successfully carried out an experiment at Cambridge which led to their conclusion that a homogeneous heavy water–uranium mixture of appropriate size would support a chain reaction.

In addition to the money and the AEC citation, Seaborg presented a plaque to the Commissariat à l'Energie Atomique. The ceremony marked the end of the French request for scientific recognition in this case, and, apparently, all parties, French and American, were pleased by the cordial manner in which it was conducted. The only thing that might have marred an otherwise enjoyable occasion for the French scientists was that—in accordance with U.S. government policy—an American wine was served at the ceremonial lunch.—B.N.

future. "The main thing is that people are mystified and therefore conclude that something very sinister is going on. It is not known to what extent research is related to war." The demand is for "real information," he said; "the question for scientists and universities is—are they being used?"

CBW is likely to get another Parliamentary airing when the question of privilege is decided. At the center of the case is Labor MP Tam Dalyell, who makes no bones about having discussed the unpublished report of his committee with the *Observer* reporter. His action, Dalyell says, was the result of his interest in seeing the activities of government research establishments linked more effectively to civilian uses. The committee visited Porton as part of its current study of defense research establishments, not because of a specific interest in CBW. Dalyell says he thinks there are "vast resources of highly skilled manpower in these establishments" not being properly utilized.

Dalyell is a talented and insistent user of the parliamentary question to focus attention on issues in the scientific and technical arena which he regards as important. The government sometimes seems to regard Dalyell's questions as embarrassing. He was a constant critic of the ill-starred variable-geometry aircraft project, and chief advocate of preserving the ecologically interesting atoll Aldabra in the Indian Ocean, which was spared from being used as a military staging post. On the CBW issue Dalyell describes himself not as an opponent of defensive research on CBW, but as a believer in open science.

Within Parliament, support for shifting control of Porton out of the ministry of defense now seems to be strongest among parliamentary Labor Party leftwing members who are particularly distressed by British government support of U.S. policy in Vietnam and who see the CBW issue in the context of British–U.S. cooperative arrangements. Support could certainly grow as more is learned about Porton.

A fair amount, in fact, is already known. The center is located about 80 miles southwest of London on Salisbury

Senate Aims Blow at Colleges That Bar Recruiters

The Senate tried to whip rebellious colleges and students back in line last week, by adding an amendment to the National Aeronautics and Space Administration (NASA) authorization bill which would deny NASA grants to institutions that bar Armed Forces recruiters from their campuses. Presented by Senator Carl T. Curtis (R–Neb.), the amendment was similar in spirit to last month's action of the House of Representatives in voting to deny National Science Foundation and Office of Education funds to rebellious students (*Science*, 17 May).

Speaking for his amendment on 10 June, Curtis said that he believed "institutions have an obligation, patriotic in nature, and in the interests of our country to cooperate with programs of the U.S. Government. . . . I do not believe that very many universities will continue this practice [of barring recruiters] if Congress takes this action." Cosponsors of the amendment included Senators Margaret Chase Smith (R–Me.), John Stennis (D–Miss.), and Strom Thurmond (R–S.C.), all military-minded conservative members of the Senate.

Although on the surface the amendment is aimed at simply forcing the colleges that ban recruiters to stop doing so, its actual results and effects might be different and far-reaching. Most NASA officials refused to comment, but one did say that the amendment would "create definite problems." He told *Science* that NASA's opinion on the amendment had not been sought. Out of the 22 institutions that now bar recruiters,* seven receive money from NASA. "Presumably some of those grants will be renewable," he said, "and then we will have to worry about this amendment." An even larger part of NASA's academic program—which involves grants and contracts totaling some $100 million in about 200 institutions—could be affected if the war in Vietnam continues and more universities bar military recruiters from campus.

Defense Department (DOD) officials are also somewhat unhappy about the amendment. In a letter to a NASA official, Albert B. Fitt, Assistant Secretary of Defense for Manpower, said that DOD "would strongly oppose sanctions" on the schools that bar recruiters. He called them "isolated situations, which are, in the large majority of cases, considered temporary suspensions rather than permanent prohibitions." He said that "in the long run" such sanctions could "serve to handicap" the entire DOD student recruitment program.

Objections to the amendment from other sources are based on the expected side effects. In actuality, opponents say, the amendment punishes people who really have nothing to do with the various institutions' decisions to bar recruiters. In essence, they argue, NASA and university scientists are the ones who will suffer—not the militant students and the administrators who succumb to their demand that recruiters be barred. The militant students may actually take some satisfaction from the amendment, seeing NASA, another vestige of the federal presence at the university, removed from their campus.

Although the amendment may not be considered terribly important by the Senate (only about 20 Senators were on the floor when the amendment was agreed to, by a voice vote), it would have significant effects on universities. Whether the amendment will make it through the House-Senate conference on the NASA authorization is uncertain as of this writing—as is the status of the House restrictions on the NSF and Office of Education appropriations—but the amendment does represent another example of many congressmen's increasingly critical view of protests on college campuses.

—ANDREW JAMISON

*According to the Department of Defense, as of 8 May the following schools have policies of barring recruiters for one or more of the military services from campus: Columbia, Fordham, New York University, Brandeis, Syracuse, University of Massachusetts at Boston, Howard, New York State University at Queens, Rutgers, Upsala, Barnard, College of New Rochelle, Finch, Long Island University, Pratt Institute, Queens, Sarah Lawrence, Central State, Hood, Oberlin, Wilberforce, and the University of Puerto Rico. The first seven now have grants from NASA.

Plain, which is otherwise renowned for Stonehenge and military maneuvers. The full names of Porton's two separate research installations are the Chemical Defense Experimental Establishment and the Microbiological Research Establishment. The CDEE has operated on its present site since 1916; MRE came out of World War II as a regular research station. The CDEE performs basic research in such predictable fields as the physics of aerosols, but is probably better known for applied research, such as the development of gas masks, air filtration units, and protective clothing, an efficient atropine injector as a countermeasure for nerve gas, and of course, CS.

The MRE's reputation is based on its fundamental research. About 80 percent of research results are published in unrestricted literature and access to the laboratory is relatively open to visiting scientists and the press. MRE claims a front-rank position in such activities as the continuous cultivation of bacteria.

The official response to critics is that offensive weapons are neither developed nor manufactured at Porton. (The exception is the production of CS gas. The United States makes its own CS but substantial quantities of British CS are supplied to security forces in many countries reportedly at a price of about $4.20 a pound. The lethal Porton-developed V-type nerve gas is said to be manufactured in the United States but not in Britain.)

The government argues that it has the duty to provide its citizens with a reasonable defense against CBW agents. To do this it must determine what a potential enemy could do and how. The point that critics make is that there is no clear line between defense and offense in CBW. Porton, for example, was able to produce large quantities of flu vaccine in an emergency and could have done the same thing if the need for vaccine had arisen during the recent epidemic of foot-and-mouth disease. Recently, and with considerable publicity, Porton scientists prepared for Soviet scientists' use samples of the virulent organism which caused the so-called "green monkey disease." This disease had been fatal to a number of German and Yugoslav laboratory workers and to the medical staff which administered treatment. It was pointed out that the equipment used had been developed at Porton to perform the difficult job of detecting agents produced by an enemy for use

NEWS IN BRIEF

● **ATOMIC ENERGY COMMISSION FUNDS SLASHED**: The House Appropriations Committee has cut-back Atomic Energy Commission funds for construction of the Weston 200-BEV accelerator. The committee has approved $7.1 million out of an original request of $25 million, which will provide for continuation of the engineering and design work only during fiscal 1969. The committee said it did not wish to provide funds which would initiate construction at this time of a project with a total estimated cost of $250 million. The committee has also slashed 41 million from AEC's proposed $72-million nuclear rocket engine development program to match earlier cuts in a similar NASA program (NERVA). The committee has allowed $31 million for the advanced rocket reactor technology program and the nuclear rocket development station operations. The Senate has not yet acted on the appropriation.

● **SWEDEN AND DOD RESEARCH**: After months of protests against the war in Vietnam and charges that U.S. Defense Department (DOD)-sponsored research in Sweden was contributing to the war effort, the Swedish Riksdag (Parliament) has decided not to change the policy of noninterference by the Swedish government in relation to DOD research. In March, some Riksdag members had proposed that the government oversee DOD projects, which total about $300,000 in Sweden and are, predominantly, for basic research studies. According to a spokesman for the Swedish government, these funds—given to individual scientists—will continue to be taxed individually.

● **ROMANIAN SCIENTISTS TO VISIT**: Dr. Donald F. Hornig, special assistant to the President for Science and Technology, has invited Alexandru Birladeanu, president of the Romanian National Council for Scientific Research, to visit the United States 19 June to 8 July. Birladeanu and his party of seven Romanian scientists will visit Washington and other U.S. cities to study scientific policies in representative laboratories of universities, industry, and government. The scientific team will also study the possibilities for broad cooperation in a science and technology exchange program between the United States and Romania.

● **NEW COMPUTER SCIENCE AND ENGINEERING BOARD**: The National Academy of Sciences has announced the establishment of a Computer Science and Engineering Board, which will include academic and industrial experts in computer and information science. In making the announcement, Academy President Frederick Seitz said, "The Board's assignment will be to assess the implications of the enormous and somewhat heterogeneous growth of information-processing technology as it affects the public and private sector of our nation." Seitz has appointed Anthony G. Oettinger, professor of linguistics and applied mathematics at Harvard University's Aiken Computation Laboratory, as chairman of the 12-member board.

● **AIRCRAFT NOISE LEGISLATION**: A measure aimed at reducing aircraft noise passed the House on 10 June. The bill (H.R. 3400) was introduced in the House by Representative Harley O. Staggers (D.–W.Va.). A similar bill (S. 707), has been introduced in the Senate by Senator Warren G. Magnuson (D.–Wash.). If it passes the Senate, the bill will grant the Federal Aviation Administration the authority to set standards for aircraft noise, including sonic boom, and to regulate control and abatement. The bill is aimed at promoting: (i) new airframe and engine designs to achieve quieter aircraft, (ii) controlled land use planning in the construction of airports, and (iii) the adoption of new flight techniques.

● **"NOBEL" ECONOMICS PRIZE**: At its tercentenary last month, the Bank of Sweden announced formation of a new international prize in economics. The prize—which formally will not be a Nobel Prize—will nevertheless be given at the same time and for the same amount as the Nobel Prizes. In addition, the body that judges and selects the Nobel Prize winners, the Swedish Royal Academy of Sciences, will also act as prize adjuror for the new award. According to a spokesman, the Academy will follow "the same principles governing the Nobel Prize decisions." The first prize will be given in 1969. The money for the award will come from a donation to the Nobel Foundation from the Bank of Sweden.

in biological weapons. But, as the critics insist, it is not a long step from making vaccines or laboratory samples to producing "offensive" organisms.

The course which the British government apparently has chosen to follow is to hold to the policy of defensive CBW research to which it is committed by having subscribed to the 1925 Geneva agreement on chemical and biological warfare. At the same time the government says it will seek CBW control measures in the 18-nation Disarmament Committee which produced the nuclear nondissemination treaty recently approved by the UN.

For the individual scientist the dilemma is an old one. Almost any scientific advance may have a destructive as well as a beneficial potential. One scientist may take the view that he bears no responsibility for how his research is applied. Another will say he is answerable for how his research is used.

In a letter to the *Observer*, E. H. S. Burhop of University College, London, expressed a corollary sentiment when he said that scientists who accept support from an establishment such as Porton "have no right to expect that the source of their research funds should be hushed up. Nor can they deny the right of their scientific colleagues to make their own judgment about the ethics of undertaking the research in each particular case." The choices for the scientist haven't changed. But what seems to be changing is that the new attention to CBW in Britain will make these choices much more public and much more widely discussed.

—JOHN WALSH

Effort Reporting: Government Drops Much-Criticized Paperwork

In response to a crescendo of complaints from the academic community, the Bureau of the Budget (BOB) has changed its reporting requirements for academics who perform government-sponsored research. The main thrust of the change is to eliminate the detailed "time-or-effort" reports previously required to justify government salary support for researchers. Under new procedures, effective 1 June, the amount of government support for faculty members will be agreed upon in advance by the granting agency and the educational institution, while support for nonfaculty researchers will be based on data from institutional payroll systems—all without the need for detailed after-the-fact reports of "time or effort" actually spent on projects.

The new procedures appear to satisfy most of the complaints which have poured from the academic community in recent years. "This is what we have been agitating for," says Lawrence K. Pettit, staff director for the American Council on Education's *ad hoc* committee on faculty time-or-effort reports. "It surprised us. We were walking around pinching ourselves to make sure it was true."

The chief reason for the change is that almost everyone concerned—the individual researchers, the academic institutions, and the federal agencies—felt that time-or-effort reports were useless and burdensome. Says Cecil E. Goode, a BOB management analyst and chairman of an interagency committee that drafted the changes: "I've never worked on a project where there was such universal antipathy to a system."

Time-or-effort reporting was inaugurated on a government-wide basis 10 years ago when the Department of Defense (DOD) was the chief government agency supporting academic research, and the contract was the main device for rendering support. The government-wide system essentially followed DOD's philosophy of requiring strict cost-accounting by contractors. In general, the system required that periodic after-the-fact estimates of time actually spent on a project be prepared by individual researchers or their supervisors. At most universities such reports have been submitted on a monthly basis, despite recent amendments which permitted as few as three reports a year.

Complaints against the system increased sharply in recent years as more and more people were required to file reports. Not only did the growth of government-sponsored research bring more people into the net, but new systems for "cost sharing" and "indirect charges" in government contracts required that additional personnel file time-or-effort reports. Often these personnel were not even receiving salary support from the government, but had to file reports because they represented a university's "cost sharing" contribution to a project.

In response to the rising objections, BOB organized an interagency task force on 1 December 1967 to investigate the problem and propose solutions. Besides Goode, who served as chairman, the group included Robert B. Boyden, of the National Science Foundation; Kenneth C. Potter, of the National Institutes of Health; Susumu Uyeda, of the General Accounting Office; and Eugene M. Wiseman, from DOD. The group interviewed 357 officials and faculty at 21 universities, plus some 30 government officials, then discussed its findings with additional representatives from the government and academic worlds.

The group found the academic community "virtually unanimous" in the belief that time-or-effort reporting was impossible to do in a meaningful way; burdensome, in that it took valuable professional time; and meaningless, in that faculty members generally fudged their reports to agree with previous budget estimates of the time they would spend. There was virtually no way for auditors to verify the accuracy of a signed effort report, since no supporting records were required. The system was said to engender a cynical attitude toward government.

The opposition of the universities was well known, but the task force found that most federal administrators were