belongs, and distinct benefit accrues to the human community at large through the benefit that accrues to those who remove the organism. Alternative grounds for destruction could be that the organism is noxious to man, either directly or indirectly through the natural community to which it belongs, and that the consequences of its removal are, on balance, beneficial.

2) There should be no further modification of, or interference with, water, air, soil, substrate, rock, or biotope unless the immediate and necessary benefits of that modification are accompanied by long-term benefits.

3) There should be neither deliberate nor careless acts in contravention of the above, either directly, as in hunting and mining, or indirectly, as in pollution and the use of insecticides.

Expressions such as "greater benefit," "not essential," and "harm" in the foregoing statement of objectives and rules would seem, prima facie, to leave the door open to all the ambiguities, equivocations, and special pleading whose reduction (elimination would be impossible) would be one of the by-products of an effective policy. Yet a close study of this text will show that these expressions are valid, *at this time.* For, if into the fabric of government (not merely into the text of some of the laws) can be woven (i) an ethic in respect of choice of objectives in resource use, (ii) a principle, drawn from an understanding of natural systems and a recognition of the inevitability of change, and (iii) a methodology, drawn from an ecological calculus, for directing and profiting by change, then the questions What? and Whom? and At what cost with what benefit? will less often be answered in selfish and expedient terms.

To me this means that the task, in a democratic society, is the double one, not of R & D, but of E & R—education and research. The greatest problems of our day lie in the fields of the ecologists and the social scientists. These sciences have yet to reach maturity; when they do, the authority with which their practitioners will be vested will be considerable. At that time it will be important that the community at large be cognizant of the concepts and practices of these sciences so as to be able to accept and assimilate their results and to keep within bounds the authority of those who have obtained the results. I see many reasons why ecology will and should take precedence in this program (*2*).

References and Notes

1. I use the word *irreversibly* deliberately, sharing with the Greek philosopher the belief that you cannot step into the same river twice.
2. As a practical step I have collaborated in the formulation of a scheme that will accelerate the growth of ecology and the dissemination of an understanding of it, by basing science teaching on studies of ecosystems; see G. L. Kesteven and R. Maddever, *Educ. News*, **11**, No. 1, 16, (1967).

3. I thank Bruce Grant and David Tanter of the CSIRO Division of Fisheries and Oceanography, whose conservation activities led to the writing of this article, and whose criticisms of its first draft led to what I believe to be important improvements in some of its argument.

NEWS AND COMMENT

Military Funds: Senate Whets the Ax for ABM, Research, "Think Tanks"

The military budget has long been the most sacred cow in Congress. But, in this year of scanty feed, an increasing number of Congressmen have concluded that it is time to subject it to the same reduction in rations that will be imposed on other federal livestock this year.

The tendency seems to be most evident in the Senate, and this is not surprising since the upper chamber has generally been the more adventurous of the two bodies in recent years. The stimuli to military budget-cutters are at least twofold. First, with a widely shared agreement that several billion dollars must be cut out of next year's budget, Senators, especially liberals, have increased their determination that the non-Vietnam part of the military budget shall be subjected to the same close scrutiny that will be given their cherished domestic programs. Second, several senators were pleased and surprised that efforts to cut military spending received impressive numbers of votes when the Senate considered the bill authorizing military hardware and R & D in mid-April. The April "revolt" against military spending seemed especially significant since it was spontaneous and was conducted without much advance notice that the bill would be brought to the Senate for consideration. Nonetheless, by a vote of 45 to 13, the Senate cut the authorization for R & D and for military hardware by 3 percent, after the committee had already sliced 3 percent from the Administration request. Senators could not remember when the Senate had last had the audacity to cut military requests on the floor of the Senate. The Senate only narrowly defeated an amendment by Senator Philip A. Hart (D–Mich.) to cut the $7.9-billion R & D authorization by more than $500 million, an amendby Senator John Sherman Cooper (R–Ky.) to prohibit deployment of an antiballistic missile (ABM) system until the Secretary of Defense certified that it was "practicable," and an amendment by Senator Joseph S. Clark (D–Pa.) to prohibit authorization of funds for the procurement of fast-deployment logistic ships.

With better organization, the military budget-choppers hope to have better luck later on this session when other military funding measures come before the Senate.

One of the most significant additions to the ranks of the military budget-cutters is the respected Senate Democratic Leader, Mike Mansfield of Montana. Mansfield not only voted for the cutting amendments but even took the extreme step of voting against the entire authorization as a protest "against the wasted billions which I believe are embodied in this measure." One area in which Mansfield is likely to make further attacks is that of Department of Defense sponsorship of research. In the April debate in the Senate, Mansfield commented that the Defense Department sponsored "almost unbelievable projects totally unknown to most Americans unless by chance one either heard about them or read about them. . . . These are projects that should be looked into and scrutinized with the greatest of care."

Although the relevant congressional committees have generally gone along

with Administration R & D requests for the Defense Department, it would be wrong to think that many important congressmen are not looking at military R & D with a critical eye. For instance, Senator John Stennis (D–Miss.), who managed the military procurement bill on the Senate floor in April and who is likely to become the chairman of the Armed Services Committee next year, admitted that he had favored a 10-percent cut in military R & D this year, although other members of his committee had prevailed in refusing to enact such a large cut. Stennis, like other members, was especially critical of Defense Department spending in the social sciences. He said that the 3-percent reduction passed by the Senate could be applied "liberally" in social science research, which he called "the softest spot in all the research and development program."

The most recent indication of the rising senatorial discontent about Defense Department research came with the release, on 21 May, of testimony from a Senate Foreign Relations Committee closed hearing at which John S. Foster, Jr., the director of Defense, Research and Engineering, testified.* The senators' doubts about the value of military research fell into three main categories: (i) the propriety of Defense Department sponsorship of social science research; (ii) the kinds of research that are sponsored by the Defense Department in foreign countries, in both the natural and the social sciences; and (iii) the value of Federal Contract Research centers, such as the Institute for Defense Analyses (IDA) and RAND, which, although technically private corporations, are subsidized almost entirely with Department of Defense contracts.

Committee chairman J. William Fulbright (D–Ark.) began the hearings by noting that the Defense Department will spend $27 million this year on foreign-policy-oriented research and nearly $40 million on research in foreign countries, while the State Department would spend only $5 million. "The committee," Fulbright told Foster, "would like to have your views on the justification for the Defense Department to involve itself so deeply in nonmilitary research."

Foster argued that it was difficult to draw a line circumscribing those matters which might be relevant for the Department of Defense or for potential military operations. After citing a Defense Department sponsored study on "Witchcraft, sorcery, magic and other psychological phenomena" in the Congo, Fulbright said, in his most acid manner, "Everything in a country could be said to be of some significance if you intend to occupy it, couldn't it?"

"Yes, sir, everything," Foster replied, and explained that he did not think that the witchcraft study was based on such an unlikely propect. Foster also said he would be "perfectly happy" to have another agency initiate some of this social science research.

"It comes back again, I suppose, to this matter of money," Fulbright answered; "Nobody has as much money as you have to spend in this and other areas. Is that the main reason you feel they are not doing it adequately and do not do this under the existing exchange program?" Foster replied that he thought the money shortage in other federal agencies was "part of the difficulty."

Later in the hearing Fulbright and other committee members zeroed in on

Department of Defense—Funding of Federal Contract Research Centers. [From transcript of Senate Foreign Relations Committee hearing on research, released 21 May]

Center	Fiscal year 1968	Fiscal year 1969 (requested)
1. Mathematics Research Center, University of Wisconsin	$1,350,000	$1,350,000
2. Human Resources Research Office, George Washington University	3,262,000	3,449,000
3. Center for Research in Social Systems, American University	1,900,000	1,960,000
4. Hudson Laboratory, Columbia University	4,800,000	4,800,000
5. Ordnance Research Laboratories, Penn State	9,557,000	9,758,000
6. Applied Physics Laboratory, University of Washington	3,127,000	3,202,000
7. Applied Physics Laboratory, Johns Hopkins	43,359,000	45,067,000
8. Lincoln Laboratories, M.I.T.	65,980,000	68,278,000
9. MITRE	32,949,000	32,900,000
10. Aerospace	72,220,000	72,220,000
11. Institute for Defense Analyses (IDA)	10,593,000	10,776,000
12. RAND	20,447,000	21,490,000
13. Research Analysis Corp.	9,992,000	10,141,000
14. Analytic Services, Inc.	1,500,000	1,500,000
15. Center for Naval Analyses	8,890,000	9,400,000
16. Illinois Institute of Technology, Research Institute	4,500,000	4,500,000

New National Science Board Members

Last week President Johnson announced his intention to nominate eight scientists and educators to 6-year terms on the National Science Board (NSB), the top policy-making board of the National Science Foundation. Approval of the nominations by the Senate is considered automatic.

Two of the nominees have just completed 6-year terms and were renominated. They are Philip Handler, chairman of the department of biochemistry at Duke University Medical Center, who has served as chairman of NSB for the past 2 years; and Harvey Brooks, dean of engineering and applied physics at Harvard.

The six other nominees include: R. H. Bing, chairman of the department of mathematics at the University of Wisconsin; William A. Fowler, professor of physics at Caltech; Norman Hackerman, president of the University of Texas at Austin; James G. March, dean of social sciences at the University of California at Irvine; Grover Murray, president of Texas Technological College; and Frederick E. Smith, professor of zoology at the University of Michigan.

The board meets about eight times a year and each of its four committees holds several additional meetings a year. Board members are paid $50 a day while they are employed on board business, plus travel expenses. The board, which consists of 24 members plus the director of NSF sitting ex officio, is expected to elect a chairman and vice-chairman at a meeting in June.—P.M.B.

* Copies of the 98-page transcript of the hearing may be obtained without charge from the Documents Room, Committee on Foreign Relations, U.S. Senate, Washington, D.C. 20510.

the "think tanks" and Federal Contract Research Centers which work for the Department of Defense. One of the things bothering senators is the fact that scientists can earn more in these research centers than they can working for the government. In response to senatorial questioning, Foster said that the highest paid employee of these centers is the president of Aerospace, I. A. Getting, who is paid $90,000 annually. He and 11 other presidents and vice presidents of these 16 centers are former employees of the Defense Department.

"How do you keep research people working for the government?" Senator Karl Mundt (R–S.D.) asked Foster. "By resigning and taking their pension they can get $55,000 to $90,000 for doing the same kind of work for the same employer under the imprimateur of a different organization."

The senators also questioned the value of the work done by the "think tanks" and cited the General Accounting Office's recent unfavorable comments on the Hudson Institute's studies on civil defense (*Science*, 5 April). After Fulbright mentioned that Herman "Thinking about the Unthinkable", Kahn, director of the Hudson Institute, had gone to Vietnam recently to advise about pacification, Mundt interjected: "I would rather take the judgment of a Taiwanese by the name of Joe China-

Micro-Revolt of the Microbiologists over Detrick Tie

At the annual meeting of the American Society for Microbiology (ASM) held in Detroit this month, outgoing ASM president Salvador E. Luria of M.I.T. stirred up a small storm of protest when he announced in his outgoing presidential address that the ASM's advisory committee to the U.S. Army's Biological Laboratories at Fort Detrick, Maryland, would be disbanded.

In itself, the dissolution of the Detrick advisory committee was not so controversial. Members of the committee* had unanimously recommended that it be discontinued because they felt it was not "serving a real advisory function as presently constituted." This action had been approved by a unanimous vote of the Council, the governing body of the ASM. What bothered some of the ASM members was the fact that Luria, in his address on 7 May, had linked the cutting of the ASM's ties with Detrick to the moral responsibility of the scientist and had said that "the ethical problems implicit in the association of a professional society with the defense establishment have always been present in the minds of the officers of the Society and have often been debated in its Councils." Some ASM members felt that Luria had misrepresented their 12,000-member organization as being ethically opposed to the connection with Detrick (the Army's biological warfare center).

At the ASM's business meeting the following day, Merrill J. Snyder, of the University of Maryland Hospital at Baltimore, said he was "shocked" by Luria's address, and introduced a resolution to reappoint the advisory committee to Detrick. This resolution passed by a vote of 172 to 58. In one of a number of telephone interviews conducted by *Science* in preparing this story, Snyder said, "I don't think that this introduction of the moral issue is in keeping with the views of the membership." Since a resolution to eliminate the Detrick advisory committee was defeated at last year's business meeting, it would seem that a majority, at least of those who attend business meetings, wishes to retain the Detrick tie.

One of the complaints of some Detrick advisory committee members was that the Army did not consult the committee on policy or on the development of specific biological weapons. Outgoing ASM president Luria told *Science* that some members felt the Detrick advisory committee had only a "peripheral" role for both Detrick and the ASM. Luria said that, for him, Detrick was "a moral issue," but he added, "I am not at all sure that my remarks represent the majority of the society."

Detrick's scientific director Riley D. Housewright (who served as president of ASM in 1966) told *Science* that he attributed the disbandment of the advisory committee to two causes. First, he said, "it is a sign of the times." He listed the Vietnam war and the increased concern about the use of biological and chemical weapons as factors contributing to the committee's dissolution. Second, Housewright said, "there are those who say that professional societies shouldn't advise federal agencies." He added that he thought many of these people would, however, "respond to a call from Jim Shannon to advise on infectious diseases for NIH." Housewright added that there were 100 members of the ASM at Detrick, more than at any other institution in the nation, and that several hundred microbiologists had directly benefited, educationally and professionally, from their work at Detrick.

The fact that the leaders of the ASM have chosen to end their organization's 13-year advisory relationship with Detrick is an indication of a shift in attitudes of a portion of the scientific community. But the fact that ASM members have urged the reinstatement of the Detrick advisory committee is a significant reminder that many scientists have not changed their minds about military-oriented research.

The Council, as the governing body of the ASM, is free to act as it pleases on the question of the Detrick advisory committee. However, Luria and others who advocated dissolution were sufficiently impressed by their opponents' ardor to suggest that the entire ASM membership be polled on the question of the Detrick relationship. In the American Society for Microbiology, as in other scientific organizations, the development of an appropriate relationship to military research will continue to be a subject for soul-searching and debate.

—BRYCE NELSON

* The membership of the most recent ASM advisory committee to Fort Detrick was as follows: J. W. Moulder, University of Chicago (chairman); Robert Austrian, University of Pennsylvania Hospital; H. S. Ginsberg, University of Pennsylvania School of Medicine; Vernon Knight, Baylor University; D. J. Merchant, University of Michigan; E. J. Ordal, University of Washington; W. R. Romig, University of California, Los Angeles; W. F. Scherer, Cornell University Medical College; and J. B. Wilson, University of Wisconsin.

man . . . rather than thinking about the unthinkable."

Fulbright quoted from a letter which former presidential science adviser George B. Kistiakowsky had written him, in which Kistiakowsky argued that, during the last 5 years, "a fairly pronounced estrangement has been developing between the academic scientists and the military establishment in that the place of the former in various Department of Defense advisory councils has been very largely taken over by professional military scientists, and those in the aerospace industry and the think tanks." Fulbright termed Kistiakowsky's statement "a very disturbing observation."

Another line of attack on the "think tanks" was the charge that they are a source of disruption to the nation's universities. Fulbright especially mentioned IDA and its connection with various university disturbances, especially at Columbia. Fulbright charged that the military research programs were not worth the disruption of universities. He went on to expand his argument, saying that Defense Department research was disturbing not only U.S. universities but also U.S. relations with other countries, particularly Japan, Sweden, and Chile. When Foster replied that he thought much of the discontent in other countries was due to the Vietnam war, Fulbright replied that disruption in relations with Sweden and Chile was not directly connected with Vietnam but, rather, was due to "the omnipresence of the Defense Department all over the world."

One Fulbright associate said that part of Fulbright's anger at the "think tanks" and at Defense Department research was due to the Department's refusal to give him an IDA "command and control" study on the 1964 Tonkin Gulf incident. "They'll be sorry they didn't give him that study," the associate predicted. Fulbright told Foster that he thought there might be other hearings on foreign research sponsored by his department.

But a good deal more than Fulbright's pique is motivating the senatorial discontent about the size of the military budget. Not only is the Defense budget becoming fair game because of the general budgetary squeeze, but also it is being criticized because, to some senators, it seems to feed an expansionist and "trigger-happy" foreign policy. Not only are Fulbright and Mansfield concerned; so are less likely antimilitary champions such as Cooper, Hart, and Stuart

NEWS IN BRIEF

● **GODDARD RESIGNS**: On 21 May, the resignation of James L. Goddard, Commissioner of the Food and Drug Administration (FDA) was announced by HEW Secretary Wilbur J. Cohen. Goddard headed FDA for almost 2½ years during which time he was criticized by drug manufacturers for tightening federal drug controls. In Washington, Goddard was judged to be a dynamic administrator. Cohen said that he was accepting his resignation with "great reluctance." Goddard will leave FDA on 1 July to become vice president of a data processing firm.

● **RACE TALK CANCELED**: The Polytechnic Institute of Brooklyn canceled a symposium of prominent scholars scheduled for 10 May because of fear that racial questions to be discussed by Nobel Prize winner William Shockley, of Stanford University, might cause problems. Shockley and 13 other scientists and philosophers, had accepted invitations to speak at a symposium sponsored by the Polytechnic chapter of Sigma Xi, a scientific society. When the sponsors learned that Shockley planned to discuss his long-controversial proposal for a scientific investigation of purported racial differences in intelligence, they asked him to choose another topic. He refused. Rather than deny Shockley freedom to speak, the sponsors then decided to go ahead with the program and organized a panel of distinguished scholars to answer Shockley. However, according to the sponsors, a group of dissenting faculty members launched a campaign to force withdrawal of Shockley's invitation, calling him a "racist" and a "Nazi" and threatening riots and disorder. Noting that "it takes but one irresponsible act to precipitate such action," the sponsors proposed to cancel the symposium, a move that was approved by a vote of the faculty.

● **EXPANDED CHEMICAL WARFARE**: The Air Force has told Congress that it will spend $70.8 million on 10 million gallons of chemicals used for Vietnam defoliation and crop-killing in the fiscal year beginning 1 July, a $24.9 million increase over this year's figure. Next year's expanded efforts are in line with the continuing increase in the U.S. chemical warfare program in Vietnam. In the first 9 months of 1967, 843,606 acres in Vietnam were drenched with defoliants and 121,400 acres with crop-killing chemicals, a figure which slightly exceeded the totals for the whole of 1966.

● **PUBLIC NEGRO COLLEGES**: The National Association of State Universities and Land-Grant Colleges has called on corporations, foundations and other private givers to provide "a massive upsurge" in their financial support of predominantly Negro public colleges. These 35 colleges and universities are largely "forgotten" when it comes to private support, the Association said. They are not eligible for help from the United Negro College Fund, and receive less than 1 percent of their income from private sources. These public colleges enroll about one-third of all Negro college students, and the families of these students have an average income of $3300 annually, compared to a national median among college students of $9500. The Association, which has prepared a booklet about these colleges, entitled *Investment in Opportunity*, noted that the Office for the Advancement of Public Negro Colleges will open in Atlanta on 1 July under the directorship of Herman B. Smith, Jr.

● **UNIVERSITY PRESIDENT RESIGNS**: The president of Florida State University, John Champion, resigned on 14 May after student demonstrations over his censorship (for obscenity) of a story in *The Legend*, the student literary magazine. The University's trustees have refused to accept Champion's resignation.

● **NIXON URGES EXPULSION**: Richard M. Nixon, the front-running candidate for the Republican presidential nomination, urged in a speech on 15 May in Oregon that Columbia University "rid the campus now" of students who created or supported Columbia's disturbances. Nixon said that the Columbia disruptions were "the first major skirmish in a revolutionary struggle to seize the universities of this country" and said that the United States was in danger of falling into the same educational pattern which characterizes Latin American universities, a system which Nixon asserted is "the worst in the world."

Symington (D–Mo.). Symington and Margaret Chase Smith (R–Me.), both members of the Armed Services Committee, have expressed grave doubts about the deployment of the "thin" Sentinel ABM system.

Rallied by their April show of strength, the Senate critics plan to stage new fights against items in military authorization and appropriation measures in forthcoming weeks. The opportunity to try to eliminate authorization of construction funds for the ABM system will probably come in June, and the Senate critics are mobilizing their forces now. There is even some talk that the administration will not fight hard against an ABM cut.

There is nothing like a "revolution" against military expenditure in the Senate, but there are signs of a small-scale uprising. Although the House has often been more conservative on such matters, the demonstration of a Senate desire to cut military funding may even have some effect on the House in this budget-conscious year. In criticizing the Senate for not slashing more from the April authorization bill, Mansfield said that the Senate had "failed to make a sufficient stab at fresh value judgments demanded by these times." Perhaps so, but from all indications the Senate is getting ready to make another stab.

—BRYCE NELSON

Israel: Science-Based Industry Figures Large in Economic Plans

Tel Aviv. The Israelis want progress, and, in the struggle for it, no strategy is more popular here than that of applying the country's considerable scientific talents to the development of industry.

Signs of this determination are everywhere:

► The three oldest, most respected academic institutions—the Hebrew University in Jerusalem, the Weizmann Institute in Rehovot, and the Technion in Haifa—have become enamoured of the "route-128" concept and have decided to copy it. The Technion (Israel's M.I.T.) and the Weizmann Institute (which grants graduate degrees and concentrates on fundamental research) are establishing industrial centers near their campuses. Both hope to share their personnel and their equipment with new science-oriented firms.

► The government has sponsored its own company to boost Israel into the computer "software" market—the lucrative business of programming and computer applications. This area of computer technology yields as much as—or more than—the actual sale of new machines, the "hardware." Israel, with 80 to 100 computers for its own needs and a good supply of skilled operators, analysts, and programmers, naturally wants to stake out a portion of the growing market. The government company, called Iltam, is now searching for "software" contracts and plans to establish an American office soon.

► One new electronics firm, Elron-Elbeit, located in Haifa, has just started exporting Israel's first commercial computer. A small desk-size machine that sells for just under $5000, it is said to be extremely sophisticated for its size and price. More than 50 have already been ordered, though the company started active marketing only in the last 6 months. Meanwhile, Elron, which makes a variety of other specialized electronic instruments, has raised its sales by more than 25 percent in the past year and expects an even larger rise next year. Employment should jump, to 300 or 400 employees. That may not precipitate corporate panic at I.B.M., but, for Israel (population 2.6 million), Elron is already a sizable enterprise.

► Science-based industry emerged as one of the "stars" of a recent Economic Conference held in Jerusalem for high government officials, the elite of Israel's private businessmen, and more than 500 wealthy, influential foreign investors. Without minimizing problems, many of the conference's participants came away convinced that Israel offers a hospitable atmosphere for research-oriented firms. The conference also generated contacts between foreign investors and Israelis, and a number of new Israeli-based companies may be formed as a result.

None of this means that Israel is about to take on Du Pont, Boeing, or RCA. With an annual gross national product of about $4 billion, the country simply does not have the resources to be competitive in most large markets. Instead, many firms have adopted the strategy of finding an area that has been overlooked, or deliberately bypassed, by large American and European firms, and then exploiting it.

A good example of this approach is the production of a small, two-engine, propeller-driven plane now being designed by the Israel Aircraft Industries. Called the Arava, the plane will fly average ranges of 100 to 500 miles (160 to 800 kilometers) and cruise at speeds up to 225 miles per hour. It will be capable of carrying 20 passengers, or, after a quick conversion, 2 tons of cargo. Demand for the Arava is expected to come from companies that operate shuttle services from outlying airports to major terminals, and from underdeveloped countries that do not need larger planes. Accordingly, Israeli engineers have designed the plane to operate from 1000-foot runways and have tried to keep operating expenses low by making the plane as simple as possible.

Similarly, many electronics firms hope to concentrate on the manufacture of small instruments. And highly specialized pure chemicals, used in small quantities in laboratory work in various parts of the world, can profitably be produced in Israel because the final product is so expensive that the extra transportation costs from Israel are insignificant.

In addition to its talent for specialization, Israel's major assets are the existing pool of scientific manpower and the relatively low labor charges. For a country so small and so young, Israel's scientific tradition is indeed well developed. Quality is high, and Israeli institutions have consistently received grants from U.S. research agencies.

In the conduct of research, cost comparisons favor Israel. For example, a study made by the Israel Financial Research Institute shows that a research Ph.D. in the Israeli pharmaceutical in-