electorate to deal with the increasing number of complex problems. The NSF has developed a "Public Understanding of Science" program to enhance science literacy. The Congress is working on a new aspect of this problem which is a "Science for Citizens" program; this Senate proposal would provide for NSF funding of groups involved with public issues that require scientific and technological expertise. It is not that we in the House shy away from controversy, nor should the NSF and the scientific community remain aloof from subjects simply because they are controversial, but that we have a genuine concern as to whether the funding of public advocacy groups is a proper function of the NSF. The entire subject requires a great deal of careful analysis.

Another concept that has received some public attention but has been only briefly considered by the Congress is the "science court." I understand that it has been discussed by the President's two new advisory groups—appointed last November as a precursor to the Office of Science and Technology Policy—in this form: Is it possible to set up a group of scientists or others who actually receive a scientifically controversial subject and try to resolve the controversy so that the outcome would be generally beneficial to society? Perhaps my political bias comes through too strongly, but my instinct tells me that science will have its primary effects on public policy as a result of political debate rather than in judicial opinion.

Indeed, I should like to encourage the organizations of professional scientists to engage in the debate on how best to increase public understanding of science and of issues having significant scientific and technological content. Another challenge for such organizations and for those of us in government is to bring about a better understanding of the essential role of industrial research as part of our total national effort. I believe that too little attention is devoted to this aspect of R & D. As Sarett testified before our committee last year, "recognition should be given to industry's special role in the effective development of products that serve a useful public purpose" (*7*).

It is evident that government and science are closely intertwined. Each affects the other, and, while the potential for "control" is present—of science by government *and* of government by science—I do not think such a simplistic reflects the realities. At times, arrogance and foolishness afflict individual politicians and scientists; petty concerns may occasionally distort the debate. Yet we seem to be devising a relationship of enduring workability for the benefit of our society. A needed element in this relationship is a continuing sensitivity to the pressures affecting the work of those in science and of those in government.

In concluding, I have the feeling that I have raised far more problems than solutions. But if I do not bring specific solutions, let me share with you a belief of my old friend and colleague, Charles Mosher, who surely is one of the wisest men ever to grace the halls of Congress. He said recently: "I could hardly think of anything more fundamental than the fact that the scientific community must no longer be timid politically in asserting what they or any individual scientist believes is important to the national interest and the interest of mankind. It will take a lot of political courage to do this." It will indeed take courage, but I find that commodity in ample supply in the scientific community.

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NEWS AND COMMENT

94th Congress: In an Election Year, Budget Process Makes an Impression

The closing out of a Congress in a presidential election year is usually a time when partisan one-upmanship prevails, and the 94th Congress, which adjourned on 2 October, proved no exception. Most observers, however, identified no clear winner in the contest between the Democratically controlled Congress and the Republican-tenanted White House, either on the legislative scoreboard or in terms of political points made with the voters. In areas where science and technology are important, Congress and the Administration generally collaborated or compromised, although on some significant environmental issues (see p. 406) President Ford and his allies in Congress nullified or delayed Democratic initiatives.

Any assessment of a 2-year Congress should look beyond the tally of new legislation to the record on appropriations and to the legislators' performance in dealing with issues that will determine how Congress will conduct its business and how it will be perceived by the public.

With respect to funding what the scientific community regards as the two bellwether federal agencies, the National Science Foundation (NSF) and the National Institutes of Health (NIH), the 94th Congress, on balance, improved slightly on the performance of its predecessor. But science, at best, barely held its own. NSF did come out of the budget battle this year with a significant boost in funds for basic research. And at NIH, where in recent years the cancer institute and, to a lesser extent, the heart and lung institute have claimed the major share of new funds, steps toward redressing the balance in favor of the other institutes were taken.

In general terms, the 94th Congress was self-consciously a post-Watergate Congress seeking to regain prerogatives lost to the Executive and to refurbish the image of the institution. The most important effort at reasserting its initiative was the experiment of the new congressional budget process, which completed a first

full year of operation after a trial go in 1975. No final verdict is yet possible on the work of the budget committees, which many insiders regard with reservations. But Congress did come very close to meeting the deadlines it set for itself and adhering to the spending targets established as key parts of the budget regimen, so the maiden voyage can hardly be termed a failure.

Amid efforts to restore luster to its public image, Congress was embarrassed by the sex scandal which resulted in the resignation of Wayne Hays, the willful chairman of the Committee on House

Bill Revising Clean Air Act Was Major Casualty as

Members of the 94th Congress packed their bags and headed home to campaign after completing a performance on the environment front that got mixed reviews. Some congressional staffers and members who had been slaving over unsuccessful measures thought the record dismal; environmental groups, however, generally thought the results respectable if not a cause for rejoicing. Several significant measures were passed despite what people on Capitol Hill said were unusually ferocious and effective lobbying efforts on the part of mining, oil, timber, utility, auto, and other interests—and in the face of an Administration whose reactions to environmental bills have ranged from reserved to actively hostile.

The biggest disappointment was the death of the bill to amend the Clean Air Act, which was 2 years in the making and which was filibustered off the floor of the Senate in the closing hours by the two senators from Utah, Republican Jake Garn and Democrat Frank Moss. The star achievement was passage of the Toxic Substances Act, which took 5 years to come to fruition (*Science*, 1 October). President Ford was expected to sign the measure, which had finally won broad support among all interested parties, despite the fact that he still clung to his objections to key provisions requiring premarket screening of all new chemicals.

Many of the congressional actions that environmentalists regarded as victories came in the form of the defeat of measures the Administration thinks necessary for energy independence—for example, the bill providing government subsidies for development of synthetic fuels, and the proposal for a $100 billion "Energy Independence Authority." Most of the environment protection bills that had support, or at least little resistance, from the Administration related to the expansion of parks and wilderness areas.

The biggest reversal for environmentalists was the downfall of the Clean Air amendments, which were supposed to have come to a final vote during the summer (*Science*, 6 May). The law contained two major features. One was a system for classifying areas that now enjoy air quality better than statutory ambient air standards and ensuring that only minimal deterioration be permitted. The Environmental Protection Agency (EPA) already has regulations to this effect, promulgated as the result of a 1974 court case, but utilities and the Chamber of Commerce have been battling the law in hopes that the regulations will be nullified in an upcoming appeal to the Supreme Court. Then there is the matter of auto emissions. The compromise version of the bill would give auto makers a 1-year delay for compliance with the 1978 statutory standards for hydrocarbons and carbon monoxide, and further extensions for the nitrogen oxides standards. Auto makers said that was not enough time, so they gambled that if the whole bill were killed they could get the lawmakers to pass a separate, more lenient, bill just for them early next year. (Auto companies are in a potentially awkward position. They have repeatedly insisted they had to know what to do about their 1978 models by 1 October. Now they know, and unless Congress springs to their rescue, they will find themselves in widespread violation of the laws.) Despite the intense lobbying by both auto companies and utilities, the bill would have had a good chance of passage had it not been for delaying maneuvers and a filibuster conducted by Garn, which resulted in the bill finally being removed from the floor. The bill's manager, Senator Edmund Muskie (D–Maine), is irate about the whole business, as are environmental groups.

Also unresolved this year was the fate of amendments to the Water Quality Act. The conference committee couldn't agree on several important issues, such as the extent of authority the EPA should have over management of grants to localities for sewage treatment plants. The main item of contention, though, was section 404 of the act that dealt with federal authority over the granting of permits for dredging and filling wetlands. Dredgers and developers have been trying to undo a 1975 court decision that broadened the authority of the Corps of Engineers to grant permits. The House bill sought to narrow it back down to apply to dredging near navigable waters and coastal wetlands; the Senate bill retains the broader existing program and splits permit authority between the Corps and the EPA. Environmentalists were glad to see this matter unresolved because they believe a more favorable measure can be developed next year when guidance will be available from the forthcoming report of the National Commission on Water Quality.

One of the major legislative achievements of Congress this year (and this one had Administration support) was the Resource Conservation and Recovery Act. What this measure does, in essence, is to give EPA its first real chance at regulating waste management and the disposal of hazardous wastes. The act establishes mandatory federal standards for the handling, transportation, and disposal of hazardous materials (such as poisonous chemicals, acids, and explosives); provides for grants to states to make plans for waste disposal and resource recovery (recycling); and authorizes $35 million for fiscal 1978 to enable EPA and the Energy Research and Development Agency (ERDA) to do research, development, and demonstration programs for waste disposal and recycling. Environmentalists were disappointed that amendments spelling out container guidelines and mandatory deposits for beverage containers were defeated, but for the most part this measure has met broad acceptance.

Another important piece of legislation was the National Forest Management Act. Some sort of timber legislation was regarded as imperative this year after a court decision that severely limited clear-cutting in national forests and had the whole timber industry in a swivet. Environmentalists seized the opportunity to push for what they regard

Administration. The House did put into effect reforms which had the effect of making its operations more open and less autocratic. On a number of matters involving ethical questions, however, the legislators proved themselves still reluctant to be their brothers' keepers.

Legislatively, the landmark issue for the scientific community—at least symbolically—was the restoration of a science adviser's office to the White House. Congress and the President agreed on principles quite early, but the process required nearly the entire 2-year life of the Congress to complete. The delay was

Congress Compiled Mixed Record on Environment

as badly needed reforms in national forest management. The resulting legislation is a compromise between a mild-mannered Administration-backed bill and one that contained explicit guidelines on clear-cutting. It puts into law for the first time the Forest Service "sustained yield" policy (cutting no more in a given year than can be replenished), and curtails tree sales in marginal areas that cannot be reforested. Specific orders about clear-cutting were dropped in favor of language telling the Forest Service to be careful. A Sierra Club official says the bill "gives the Forest Service one last chance" to show it can manage clear-cutting responsibly, and he predicts the law offers new handles for "a number of productive lawsuits" next year.

Energy Directions Unclear

On measures relating directly to energy, matters seem to be at something of a standoff between environmental interests on the one hand, and the Administration and industry interests on the other. The President's veto of the federal coal leasing act (which tightens federal management of its coal resources) was overridden by Congress, but he had his wish when the latest version of a federal strip-mine reclamation act was allowed to founder for a second time in the Rules Committee. This law is regarded as crucial by environmentalists now that the way has been opened for leasing of coal-rich lands in the West. The proposed measure, already vetoed twice by the President, would supersede the patchwork of state laws now regulating strip mining and contains, among other things, stringent reclamation guidelines for private as well as public lands and provisions for protecting the rights of surface owners. The United Mine Workers had been supporting the bill until recently when it changed its stance at the behest of Eastern strip-mine operators. The Department of the Interior has maintained that its newly issued regulations for reclamation on public lands make a law unnecessary.

Another environmental defeat was that of the amendment to the Outer Continental Shelf (OCS) Lands Act, rejected by four votes in the House on 28 September. This bill would authorize the Interior Department to conduct exploratory drilling, change bidding procedures, add new environmental safeguards, and give states more say over the onshore aspects of offshore development. The Interior Department hates the bill, and oil companies have claimed it would cause them intolerable delays and expense.

On the plus side for environmentalists has been the defeat of several measures that would encourage what they see as reckless development of energy resources. The House, by a one-vote margin, voted not to consider a bill that would have provided $4 billion in subsidies to industry for development of synthetic fuels. The measure, vigorously promoted by the Administration, would stimulate strip mining and oil shale exploration in the West.

Another subsidy bill that was defeated was the Nuclear Fuel Assurance Act, which would have provided $86 million for uranium enrichment by privately operated companies, a development the Sierra Club said would lead to "environmentally unsound expansion of enrichment facilities."

Other developments pleased environmentalists. One was congressional failure to pass the ERDA authorization bill which would have provided funds for the controversial Clinch River breeder reactor demonstration program, and given ERDA authority to subsidize the commercialization of demonstration energy projects whose worth is open to question. Another encouraging sign was the Senate's failure to confirm the nomination of George Murphy, staff director of the Joint Committee on Atomic Energy, to the Nuclear Regulatory Commission. Murphy, a JCAE staffer since 1958, was regarded as being too pronuclear.

As for action on energy conservation, progress has been minimal. The notable exceptions are measures offering federal subsidies for energy-conserving technologies in building construction, and mandatory "performance standards" for new buildings.

The Congress seems to have made the most strides in areas, such as management of public lands where the members have not been besieged by frenetic lobbying. An important move was passage of an Organic Act for the Bureau of Land Management, which brings all BLM lands—comprising one-fifth of the nation's territory—under a single charter and enables the agency to recommend withdrawals of lands for designation as wilderness areas. Congress also tripled the money available for purchase of lands for parks and recreation, extended designations of wilderness areas, passed a bill to prevent mining in a number of national parks and monuments, and put a moratorium on existing mining claims in Death Valley National Monument.

Obviously, the next Congress will be confronted with a good deal of unfinished business, notably in air, water, strip mining, and OCS leasing. According to a spokesman for Environmental Action, environmentalists will be gearing up for a new assault on chronic problems—hammering away at the Highway Trust Fund to get money for mass transit, and pushing for more laws relating to nuclear proliferation and nuclear safeguards, to name a few. A Sierra Club worker observes that if President Ford is elected, the pro-environment forces will be mainly occupied in "defensive" actions; if Carter wins, they see opportunities for a great array of new initiatives.

There were quite a few close fights this year, and environmentalists feel that the balance sheet would look significantly different if legislators had not been dealing with a President who put a much higher priority on economic recovery than on environmental protection.

—CONSTANCE HOLDEN

caused first by differences between House and Senate about the prospective functions and priorities of the office (*Science*, 16 April) and then, after the bill was passed, by the President's apparent hesitancy to go ahead with the nomination of H. Guyford Stever in the face of objections by a small group of Republican senators (*Science*, 2 July). Stever, who was ultimately nominated and easily confirmed, appears to have been a popular choice in the scientific community. He has been cast in something of caretaker role, however, because of the imminence of the election and because of his own unannounced but anticipated post-election departure from government.

In the health field, a signal accomplishment was the passage of a revision of health manpower legislation that had been debated desultorily for the past 3 years. The original legislation had been shaped in the 1960's by congressional determination to increase the numbers of physicians and other health professionals being trained. In recent years, concern has shifted to the problems of medically underserved areas, specifically inner-city and rural areas, and to a scarcity of physicians in the so-called primary-care specialties. A number of proposals to use federal funds to exert pressure on medical schools and on individual physicians to respond to these problems were resisted by national medical organizations on the argument they were coercive. The new bill contains several compromise features, including a provision for increased scholarship aid contingent on physicians' agreement to practice in medically underserved areas. Much tighter future restrictions on foreign medical graduates are also included in the bill.

A much more protracted struggle over revision of existing legislation has finally produced a new copyright law. Despite the proliferation of new communications technology, the old law, which was enacted in 1909, had never been comprehensively overhauled. The efforts that culminated in passage of the new law date back at least to the early 1960's.

For the scientific community, the crucial section of the legislation governs library photocopying, which has been the subject of protracted litigation in recent years (*Science*, 14 March 1975). The photocopying provisions of the new law represent an effort to reach a compromise in protecting the interests of publishers of scholarly journals and books and of research libraries, which regularly provide photocopies of scholarly material.

The fair use section of the bill does appear to make special allowances for photocopying when it is for nonprofit educational purposes. However, libraries are permitted to make single copies of copyrighted material under conditions which appear to impose considerably tighter restrictions on the libraries than have prevailed in the past. The tentative appraisal from research librarians is that they can live with the new law, but they defer final comment until the appearance of the federal regulations interpreting in detail what librarians can and cannot do.

As for funding trends, the final appropriations figures for NSF and NIH appeared to cover costs of inflation and a little bit more. The total appropriation for NIH for the 1977 fiscal year was well over $2.5 billion compared with barely $2.3 billion for FY76. Congress provided nearly $350 million more for NIH this year than President Ford requested in his budget. Both the cancer institute, which has a budget of $815 million this year, and the heart and lung institute were, in effect, treated like most other institutes, receiving funding increases in the 6 to 7 percent range. Special increases went to programs given high priority by Congress, notably diabetes research, and to several institutes, including environmental health science, aging, and allergy and infectious diseases. Congress also raised the amount of construction money appropriated to $67.4 million from the $25.4 requested by the President in order to finance facilities for the National Institute of Environmental Health Science in Research Triangle Park, North Carolina.

NSF Budget Is Up

NSF fared reasonably well at the hands of appropriations committees after an early scare that the House might impose substantial cuts on its budget. The final appropriations action will bring NSF's total funding for FY77 to $783.6 million, almost $29 million less than NSF requested but still a hefty boost over the $720 million expended in FY76. The bulk of the increase will go to the three programs at NSF which support basic research—namely, mathematical and physical sciences and engineering; astronomical, atmospheric, earth, and ocean sciences; and biological, behavioral, and social sciences. Congress appropriated $582.6 million for these programs in FY77, up from $520.9 million in 1976. Although NSF, as is true of most agencies, got less money than it sought from Congress, the shortfall will apparently cause no real problems. One NSF official commented: "The trauma is at a minimum compared to other years."

In the realm of military R & D, Congress followed the line it took with the defense budget as a whole, generally reducing appropriations somewhat below the President's request for this year but providing substantially higher totals than last year. Congress voted a total $104.5 billion for the military compared with the $107.9 billion in the Ford budget request. This appropriation was about $14 billion higher than Congress provided last year. Congress voted $10.4 billion for military R & D compared with $11.5 requested by the Administration. Several controversial weapons systems were hotly debated by Congress during the authorization process earlier this year, but Congress went along with the Administration on these issues at appropriations time. Congress, for example, approved an Administration request for $948 million to build the first three B-1 bombers, although it prohibited awarding of a production contract until after 1 February 1977, which falls after inauguration day. Congress also voted the full $791.5 million requested for the third Trident submarine and $720 million for development of the Trident missile (*Science*, 9 January). Congress reduced the sum appropriated for development of a sea-launched version of the cruise missile to $119.8 million from the $182 million asked by the Administration, but provided another $79.3 million for research on an air-launched version as requested.

The 94th Congress started with a bang when the House, in a selective breach of the seniority system, replaced three senior committee chairmen (*Science*, 10 January 1975) and launched a number of procedural reforms that had been voted in late 1974. Some of these changes, notably opening to the public the meetings in which House and Senate conferees thrash out the final form of legislation, have made a substantial difference. Congress has not been transformed, but the reformist mood persists. The Senate has under way several projects of organized self-examination (*Science*, 14 May), and the Democratic Study Group is readying itself for a new round of reform proposals for the House.

From the standpoint of many observers, including science agency officials, the major impact on Congress in the past 2 years has indeed been the new budget process. For science agencies it seems to have been something of a mixed blessing. Lags in acting on money bills have made planning particularly difficult for agencies with major R & D and education programs. NIH has suffered in recent years as the Health, Education, and Welfare appropriations bill has been caught repeatedly in rows between Congress and the Administration, sometimes so that a fiscal year has actually ended

with no appropriations bill enacted and previous-year funding provisions in force. Performance under the new process gives promise of more reliable appropriations action. The increase in efficiency, however, may be accompanied by a tightening congressional grip on funding. Agency officials see a tendency for congressional and Administration budget attitudes to converge as Congress sets overall spending limits and then strives to stay within them. They suspect that, for R & D in the future, in more than one sense, there may be less give in the system.—JOHN WALSH

The Plight of American Science: Sad Tales from Research Directors

Unstable funding is driving some first-rank institutions toward collapse; the brightest students are moving away from basic research; bureaucratic and economic constraints are strangling the freedom of research; and anti-intellectualism is on the march.

That, in brief, is the state of American science as viewed by leaders of research institutions whose views are set forth in the eighth annual report of the National Science Board, the policy-making body for the National Science Foundation.

This latest report—entitled "Science at the Bicentennial—A Report from the Research Community"*—provides a subjective counterpart to its immediate predecessor. The last annual report sought to measure the strength of American science through objective indices, most of which suggested that American leadership in science and technology is slipping (*Science*, 12 March, p. 1031). Now the new report fleshes out the picture by presenting the subjective concerns of research administrators responsible for a substantial part of the American scientific effort. It is a view from the top of the research system, not from the vantage point of the scientist at the bench.

Letters of inquiry were sent to more than 900 persons active in the administration of research at universities, industrial concerns, federal laboratories, and independent research institutes, ranging from university and corporate presidents down to department chairmen and laboratory directors. Each was asked to describe the two most critical problems facing basic research in the near-term future, particularly those which would decrease the effectiveness of research unless properly addressed. Some 640 individuals responded to the survey in the summer and fall of 1975.

The striking thing about the responses, according to the National Science Board, is that individuals from all types of institutions largely agreed on what the major problems are and showed similar "intensity of concern" about the problems.

The report makes no great effort to interpret the significance of its findings. For the most part it just breaks down the responses into four main categories of concern and then quotes extensively from the letters sent in by research administrators, letting the anguished scientists speak for themselves. The report thus presents much information on what research administrators perceive to be the problems, but it sheds little light on how accurate those perceptions might be. In at least one area of concern—public attitudes toward science and technology—there are data in the report to suggest that the research administrators are more gloomy than seems justified by available evidence.

One major problem cited by the administrators is lack of continuity and stability in funding for research, exacerbated by lack of planning and policy-making. The industrial executives warned that inflation, low profits, and decreased availability of capital are leading many companies to cut back, or even abandon, basic and exploratory research, a step which many viewed as potentially harmful to long-term economic growth and the competitive position of American industry. As N. B. Hannay, vice president for research and patents at Bell Laboratories, put it:

> . . . I would say that the single most critical issue with respect to long-term research in industry is that it is not being done, for the most part. A few companies in a few industries support it, but the bulk of industry has either given it up or never did it.

University officials had similar complaints about unstable funding, but they cited a different cause—fluctuations in government support. Jerome B. Wiesner, president of the Massachusetts Institute of Technology, called the fluctuations "extremely damaging" and said they had produced "serious imbalances between fields"; "the destruction of many research teams"; "the underutilization of important facilities"; and an "apparent lack of opportunity in some fields which drives good young people away, only to present us with 'shortages' in the future."

Sidney G. Roth, vice-chancellor for federal relations at financially troubled New York University, was even more glum as he predicted:

> Some first-rank institutions will probably collapse. Is that the price the nation must pay before the system is corrected?

Just what should be done to improve things was not always clear to the administrators. Many urged better planning and policy-making, multiyear commitment of funds for research programs, some form of institutional support (the second-rank universities wanted this, while the first-rank universities were indifferent), and tax incentives to stimulate industrial research. A significant minority of the university administrators wanted not just stability of funding but more total dollars as well, even though the letter of inquiry had tried to steer them away from complaining about dollar support.

A second major problem highlighted in the report is the "vitality of the research system"—the extent to which it attracts new talent and enables it to advance and work productively. Many educators have previously reported a decline in the number of students entering various scientific fields, but a surprising number of administrators told the National Science Board there has been a drop in the quality of the students as well. As Clayton S. White, of the Oklahoma Medical Research Foundation, put it:

> . . . the best talent among the country's youth is not moving into scientific research today compared with the case 15 to 20 years ago. Medicine and engineering, along with other professions, are attracting much higher caliber people. . . .

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