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. . . .

*Available from the Government Printing Office, Washington, D.C. 20402. $2.95. Stock No. 038-000-00280-5.

That sentiment was endorsed by Hans Mark, director of NASA's Ames Research Center, who commented:

> I have noticed in the past eight or ten years a distinct drift of our very best people away from the basic fields . . . the quality is not as good as it once was.

The industrial leaders felt especially deprived, since the best of this poorer crop of students seem oriented toward academic careers. "If graduate training conditions the best scientists and engineers to disdain an industrial career, then I believe the universities are not making an adequate contribution to the productivity of technically based industry," wrote Leonard Swern, director of technical programs for the Sperry Rand Corporation.

Both the universities and the federal laboratories report difficulty in absorbing "new blood" into their systems. In the universities, declining enrollments and the tenure system have combined to reduce the number of positions open to young scientists, with the result that aging faculties are being frozen into place. In the federal laboratories, few people are leaving voluntarily in the face of a tight job market, and personnel ceilings make it difficult to hire new staff.

There was little consensus on what to do to enhance the vitality of the system. Various administrators offered suggestions ranging from a complete overhaul of the academic world to providing fellowships for bright students.

A third problem involves infringement of the freedom of inquiry—"the right of the scientist to choose his own line of research and follow it wherever it may lead." Some industrial administrators complained that economic factors were interfering with their ability to conduct basic research. But most administrators portrayed government, at the federal or state levels, as the chief villain in curbing their freedom. They complained that government funding is accompanied by pressures to do targeted or applied research rather than basic research. And they expressed resentment about overmanagement or overregulation of research by the government.

University officials lamented that the red tape involved in federal reporting requirements is reducing researchers to paper shufflers and sending them scurrying to other fields where the reporting burden is less onerous. Industrial executives charged that government regulations and controls are driving the cost of developing new products to prohibitive levels and forcing companies to divert funds from basic research to "defensive research" designed to insure compliance with the regulations. But probably no administrators were more upset than those who head government laboratories and must report directly to higher administrative layers in the bureaucracy. Harold M. Agnew, director of the Los Alamos Scientific Laboratory, predicted, somewhat apocalyptically, that:

> The ever increasing bureaucracy composed of managers who require more and more detail, justification, and guaranteed schedules, will in the not too distant future completely eradicate our Nation's world position in research and technology.

The remedies suggested were variations on three themes: fund more basic research, give researchers more freedom in their choice of projects, and bring applied and basic research into better balance.

The final concern highlighted by the research administrators is an alleged decline in confidence in science and technology. Many of the administrators asserted that both the public and the government in recent years have lost confidence in research and those who perform it. Some even professed to find negative attitudes toward research within the universities themselves. This negative attitude was held to be a major factor in reducing financial support for science, driving young people away from research careers and causing most of the other problems cited in the report. "It may not be too extreme to say that in three decades the scientist has gone from the role of hero to villain in our society," commented Dexter P. Cooper, Jr., vice president of Bell & Howell.

That view may represent the fears of the laboratory directors, but it does not find much support in the results of recent opinion surveys that are summarized in one section of the report. Those surveys indicate that public esteem for a variety of institutions and professions has dropped since the mid-1960's and that scientists have shared in that drop. But in relative terms, scientists have held their own or even gained in comparison with other professions. The surveys show that scientists command "a high degree of respect," that science is "highly regarded," and that technology is "widely supported," despite concern over its side effects. Young people do not appear "generally disaffected with either science or technology."

The report has been transmitted to the President and Congress, where it is apt to be widely ignored. In the coming months the National Science Board plans to hold regional forums in different parts of the country to gather additional views that may prove useful in reaching "general agreement on solutions and how best to put them into effect."

—PHILIP M. BOFFEY

West German Science: Trends Mirrored in a Max Planck Institute

The Max Planck Institute for Biophysical Chemistry stands in white and pristine aloofness on a hill overlooking the old university town of Göttingen, West Germany. But it has not been able to escape the pressure and strains that have recently begun to be felt in German science both within and outside the Max Planck Society. These include financial cutbacks, the call by politicians for a more "people-oriented" brand of research, and demands by younger scientists for more say in an institution which by tradition has not placed much stock in a democratic approach to research problems.

The Max Planck Institute for Biophysical Chemistry is largely the brain child of Manfred Eigen, who received the Nobel Prize for Chemistry in 1967 for developing "relaxation techniques" for following the course of extremely rapid chemical reactions. Eigen felt that there was a need for an institute in Germany which would integrate the most advanced ideas and techniques of physics, mathematics, laser technology, and computer sciences with the expansion of new research frontiers in the areas of molecular biology, biochemistry, neurobiology, and neurochemistry. Putting many scien-