which would lessen its environmental impact. A partial list of the problems that need further investigation would include: removal of sulfur pollutants from stack gases or from the combustion process; technology to place high voltage lines underground; technology to convert coal to gas so as to supplement the dwindling natural gas supplies; development of better, more economical cooling towers to deal with thermal pollution; methods for utilizing our shale oil resources effectively; techniques for applying waste heat to beneficial uses, including, perhaps, the heating of water for homes and commercial establishments; development of magnetohydrodynamics to increase the thermal efficiency of electric power generation; and development of such new sources of power as solar energy, geothermal heat, tidal energy, and fuel cells.

In the long run, the nation's power problems will probably have to be solved by nuclear energy. The recent report "Resources and Man," published by the Committee on Resources and Man of the National Academy of Sciences-National Research Council, gave a rather gloomy picture of the prospects for other energy resources. It estimated that "the earth's coal supplies are sufficient to serve as a major source of industrial energy for two or three centuries. The corresponding period for petroleum, both because of its smaller initial supply and because of its more rapid rate of consumption, is only about 70-80 years." Natural gas, solar energy, water power, geothermal, and tidal energy were all dismissed as holding little promise for meeting future energy needs. Even the current generation of nuclear reactors will deplete the supplies of uranium-235 at an alarming rate and will have to be replaced by breeder reactors before the uranium situation becomes critical in just a few decades. Failure to make the transition to breeders, according to the Academy committee, "would constitute one of the major disasters in human history." Still further on the horizon is the possibility of fusion power, which would offer the advantage of virtually unlimited fuel with relatively little adverse effect on the environment. But no one is certain that fusion power will ever be achieved or will ever prove practical.

Meanwhile, the conflict between the desire for more energy and the desire for a clean environment will continue unabated. The best hope for resolving the conflict probably lies in various technological breakthroughs. Both sides stand to gain from a satisfactory resolution of the problem, for both sides may come out losers if the conflict continues and escalates. The energy industries stand in jeopardy in that their future growth may be curbed. And the environmentalists, if they push the country into a severe energy crisis, may find that they have undermined their own cause. Once the air conditioners and television sets start going off, the public will probably say, "To hell with the environment, give me 'Bonanza.'"

—PHILIP M. BOFFEY

Federal Graduate Aid: Down But Not Out

When the National Institutes of Health (NIH) announced plans last week to phase out its predoctoral fellowship program, the news deepened the gloom of those who see current cutbacks in federal support of graduate education as producing a crisis within a crisis caused by the slump in federal funding of science.

It is still too early to forecast in detail the effects of the cutbacks in the coming academic year, but many departments are anticipating smaller enrollments of graduate students attributable both to a reduction in the number of federal fellowships and traineeships and also to the decreasing availability of research assistantships financed out of research grants.

If there is a bright spot, it is to be found in signs that the Administration is veering away from a policy of changing the primary form of direct federal support to graduate education from fellowships and training grants to guaranteed loans. For those who feared that the prevailing system of federal grants was to be supplanted there is some consolation that the grants are headed down but not out.

Ambiguity in prospects for September arises from the usual fudge factors that afflict science manpower data and projections. On the federal side, Congress has not passed the main appropriations bills carrying funds for support of graduate education for fiscal year 1971. (A substantial part of these funds will actually be spent in the 1971–72 academic year.) The chronic lag in agency data collection and reporting prevents the formation of a clear picture of the situation in graduate support in the academic year now ending or in the progress of awards for the coming year.

Out in the universities, there are doubts about how the draft will affect enrollments in September. And since many universities are facing serious deficits this year, there is talk of emergency economy measures that could affect graduate enrollments. Although some indicators run counter to predictions of contraction of enrollment (the University of California at Berkeley, for example, announced last week that applications for admission to graduate school were up 25 percent over last year), the difficulty of finding financial aid is likely to be a restricting factor on enrollments this year.

The general shape of federal support of graduate education in the coming year seems, however, to be following the outlines set in the Administration budget. An agency-by-agency check last week yielded the impression that, although congressional efforts to increase some items in the science budget may succeed (*Science*, 3 April 1970), the overall contours of the budget and of graduate education support have been set by the Administration's fund requests.

The National Aeronautics and Space Administration (NASA) has for all intents and purposes liquidated its sustaining university program with which it underwrote the rapid buildup of space-science graduate training in a broad range of universities. The NASA doctoral support program peaked in 1968, when some 1300 students were

Faster FDA Action Asked in Lawsuit

The Food and Drug Administration (FDA) last week came under increased pressure to act more rapidly against unsafe and ineffective drugs. The American Public Health Association (APHA) and the National Council of Senior Citizens (NCSC) filed a lawsuit in the U.S. District Court in Washington, D.C., charging the FDA with violation of the 1962 Kefauver-Harris Drug Act. The act, passed in the wake of the thalidomide scandal, required the FDA to certify all drugs on the market as safe and effective. To implement the act, the agency commissioned a study of all drugs by the National Academy of Sciences–National Research Council (NAS-NRC). The massive study was finished in July 1969, but the FDA has so far released only about 15 percent of the results.

The FDA is charged with delaying 8 years in implementing the act, with failure to release immediately the NAS-NRC report, and with failure to follow proper steps for the swift removal of substandard drugs from the market.

The main controversy centers around the definition of "imminent hazard." By labeling a drug an imminent hazard to public health, the FDA can force its immediate removal from the market. FDA spokesmen claim that no drug now on the market is an imminent hazard. FDA Commissioner Charles C. Edwards said, "When we find an imminent hazard to public health we will not hesitate to invoke the procedure." But the exact definition of what constitutes an imminent hazard has never been delineated.

The lawsuit charges that an imminent hazard labeling should have been issued for a category of diuretics—the potassium thiazide combinations—and 50 anti-infection mixtures, including combinations of penicillin and streptomycin (pen-streps). The NAS-NRC study showed that the indiscriminate use of pen-streps has led to a proliferation of resistant organisms, which threaten worldwide epidemics.

The FDA, however, has chosen to avoid using the imminent hazard labeling and instead has used the phrase "serious hazard for some users." This semantic difference has permitted the drugs to remain on the market while their manufacturer fought the FDA ruling in court.

According to Edwards, the NAS-NRC reports cannot be released immediately because "they are subject to interpretation and, unless guidance is provided as to labeling revisions and other changes required, a chaotic situation could result." He added that the FDA is working as fast as possible to produce the needed guidelines and that he expects all the reports to be released by the end of this year.

The decision to file a suit represents a major escalation in the years-long battle to make the FDA act more rapidly. The idea for the suit originated with Dr. Robert McCleery, a former member of the FDA and currently a consultant to Ralph Nader's Center for Responsive Law. McCleery enlisted the support of the APHA and the NCSC in December.

McCleery called the suit a "last resort, taken because administrative procedures such as congressional hearings and letters to the FDA have failed to produce any change." He charged that the real reason behind the FDA's failure to act more quickly against unsafe drugs is that "it fears political and economic consequences if a large group of drugs were rapidly removed from the market." The FDA denied the charge and blamed delays on involved court fights with drug manufacturers (*Science*, 29 August 1969).

The suit also marks a significant change in policy by the APHA and the NCSC. Neither group has ever before filed suit against a federal agency.

Nelson Cruikshank, president of the NCSC, said that the suit opens the way for similar actions by his group against other federal agencies.

—THOMAS P. SOUTHWICK

being funded, but the last few to receive NASA funds will finish up next year. NASA will, however, still provide indirect support of graduate students through research assistantships financed under the $75 million in research grants to universities.

The NIH announcement that predoctoral fellowships would be phased out actually made official what had been foreshadowed by cuts in fellowships in recent years. Training grants are the chosen NIH instrument for support of predoctoral students, and some 5000 are now being supported through the program. The variety of NIH programs and the peculiarities of the agency's financing and record-keeping make it difficult to pull together exact quantitative data, but the decline in NIH support of postgraduate education and training is indicated in broad outline by the fact that there were an estimated 15,000 NIH training grants of various kinds in 1968, perhaps 10,000 of them supporting predoctoral students, while this year the total is about 11,000, with about 5000 of them supporting predoctoral students. In addition to phasing out predoctoral fellowships, NIH has been under instructions from departmental headquarters to examine the teaching mission of NIH. The implications at first were that grant programs were to be converted to loan programs, but now NIH planners say emphasis is on relating its training grant programs to concrete needs for the people trained.

The National Institute of Mental Health (NIMH) this year is absorbing a sharp curtailment of its predoctoral fellowship program, with the number of new and competing fellowships cut from 105 in fiscal 1970 to 53 in fiscal 1971. This means a drop in predoctoral fellowships from 750 in the current year to 491 next year. Postdoctoral fellowships will be more than halved, dropping from the current 105 to 53, as new and competing awards are reduced from the 73 made in the current year to 44.

In absolute numbers, the biggest single federal predoctoral fellowship program is operated under the National Defense Education Act (NDEA). In fiscal 1968 some 6000 new fellowships were awarded, and the total number of individuals being financed was 15,000. In the current fiscal year (1970) which ends on 30 June, new fellowships dropped to 2370 and the number in fiscal year 1971 is scheduled to be 2200; thus the total number supported under

the 3-year fellowships will be about half the 1968 total. Perhaps half the "new starts" in the coming year will be in the physical sciences and mathematics, since NDEA fellowships are awarded in the humanities and social sciences as well as the sciences.

Despite an Administration decision to put more of its basic-science eggs in one basket, which favored the National Science Foundation (NSF), there will be a net reduction in graduate student support by the agency. The number of NSF fellowships is to be increased modestly from 2220 under the 1970 budget to 2530 in the 1971 budget. But in the traineeship program, which has been NSF's mainline program of predoctoral support, no new traineeships are to be awarded in fiscal 1971. NSF's traineeship program peaked in 1968 when 2211 new awards were made, and the total reached 5666. In the current fiscal year, 1897 new starts (tenable in the coming academic year) are scheduled, and the total will drop to 5123. By academic year 1971–72 when the impact of no new starts in fiscal 1971 hits, the total will probably be down to half the peak number.

NSF officials say that the suspension of traineeship awards does not necessarily mean that the door is closed definitively on the traineeship program. The agency has, however, like other federal science-supporting agencies, been exploring the question of shifting to a "loan operation" in support of graduate education.

There has been considerable speculation on whether the Administration will press on in applying to graduate education the principle—which it espouses for federal support of undergraduates—of guaranteeing loans rather than providing grant support. The most definitive Administration statement on the subject to date was contained in a letter written in late April by Presidential Counsellor Daniel P. Moynihan in reply to Harvard President Nathan M. Pusey, who is also serving this year as president of the Association of American Universities.

In his letter Pusey made the point that "our experience commands us to urge that graduate students should be supported primarily by fellowships rather than loans." In his reply, Moynihan commented on this point as follows:

> The Administration does not disagree that graduate students should be supported by fellowships as well as by loans. (One science dean tells me that at his institution it costs something in the neighborhood of $900,000 to produce a Ph.D. in radio astronomy. It would be hard to expect young scientists to go into hock for such amounts, and of course they do not.) The [proposed Foundation on Higher Education], when established, will continue to grant college teacher fellowships in the amount, at the very least, of the present program.
>
> Fellowships will, of course, also continue to be available from the many other Federal agencies that presently provide them and, under the President's proposals, graduate students will be eligible for substantially increased loans. We believe that the foundation should carefully examine national manpower needs in the highly specialized fields that are supplied by the nation's graduate schools and should determine those areas that warrant fellowships support. At the same time, the increase in student loan funds would also preserve the individual graduate student's freedom to seek schooling in any field of his choosing.

The policy is the product of a Bureau of the Budget forced by pressures of Vietnam war costs and inflation to make cuts in areas of controllable spending—like support of graduate education.

There is at least a prima facie supply-and-demand argument for the cuts, since Ph.D.'s are facing a job squeeze unprecedented since before World War II.

But the shift, even a partial one, from grants to loans in graduate support, represents a major shift in science policy, and there has been remarkably little public discussion of policy or of the immediate impact on research institutions or of the longer-term effects on manpower.

It is said that Administration espousal of selective grant support for graduate students marks a change from an earlier inclination toward a wholesale shift from grants to loans. And inside lobbying by Presidential Science Adviser Lee A. DuBridge and his aides at the Office of Science and Technology is said to have helped to change the Budget Bureau stance.

A further opening up of the discussion may be effected by the forthcoming report of a President's Science Advisory Committee (PSAC) panel, chaired by Patrick Haggerty of Texas Instruments. If hopes for it are fulfilled, the report on manpower will be a 1970's version of the oft-referred-to report of the PSAC committee chaired by M.I.T.'s Edwin R. Gilliland in the early 1960's.

A sense both of urgency and of good timing is revealed in efforts by the new group's subpanel on academic science, chaired by Caltech's Murray Gellmann, to complete a report by September so that it may serve as input in the process of budget making in the coming year.

It should be possible with better planning to minimize damage done in a period of budget contraction, but, unless policy makers come squarely to grips with problems posed by cuts such as those in graduate support, they are likely to find themselves locking the lab door after the researchers are gone.

—JOHN WALSH

APPOINTMENTS

R. C. Wood

R. B. Leighton

Robert C. Wood, director, Center for Urban Studies, M.I.T.-Harvard, to president, University of Massachusetts. . . . **Robert B. Leighton**, professor of physics, California Institute of Technology, to chairman, division of physics, mathematics and astronomy at Caltech. . . . **Norman H. Cromwell**, chairman, chemistry department, University of Nebraska, to executive dean, graduate studies at the university. . . . **Carl J. Nyman**, chemistry professor, Washington State University, to dean of the graduate school at the university. . . . **David M. Gates**, director, Missouri Botanical Garden and professor of biology, Washington University, St. Louis, has been named chairman, Environmental Studies Board, National Academy of Sciences–National Academy of Engineering. . . . **Martin D. Jenkins**, president, Morgan State College, to director, new office of urban affairs, American Council on Education. . . . **Paul B. W. Gollong**, United Nations project manager in Israel, to senior scientific affairs officer, United Nations Office for Science and Technology. . . . **Robert M. Bird**, associate dean for planning and development, University of Oklahoma, to dean, School of Medicine at the university.