now evidence that the rate of yield increase may be slowing. Nonrecurring inputs may have made their maximum contribution to output in the case of some crops, pushing yield levels past the middle of the S-shaped logistic curve. Although this cannot be determined with any certainty, the possibility that the middle of the curve has been passed in some instances should be taken into account in viewing the long-term future.

7) If the rate of increase in yield per acre does in fact begin to slow in some of the agriculturally advanced countries, additional pressure will be put on the less-developed countries—which have much of the world's unrealized food-production potential—to meet the continuing future increases in world food needs.

8) Man has not yet been able to bypass the process of photosynthesis in the production of food. This dependence on photosynthesis plays a significant role in determining the upper levels of the S-shaped yield curve. Additional research is urgently needed to increase the photosynthetic efficiency of crops and to raise the upper levels of economically feasible yields.

References and Notes

1. I have previously examined these matters in some detail in "Man, Land and Food," *U.S. Dept. Agr. Foreign Agr. Econ. Rep. No. 11* (1963).
2. I have discussed this concept at length in "Increasing World Food Output," *U.S. Dept. Agr. Foreign Agr. Econ. Rep. No. 25* (1965).
3. For further discussion of this point, and the role that may be played by private industry, see L. R. Brown, *Columbia J. World Business* **2**, No. 1, 15 (1967).
4. As one leading agricultural economist recently stated, there is considerable evidence that in most low-income countries "technological advance requires a complementary input of labor" [J. Mellor, *The Economics of Agricultural Development* (Cornell Univ. Press, Ithaca, N.Y., 1966), p. 157].
5. The "nonrecurring" concept was introduced by Paul C. Mangelsdorf; (see *6*).
6. P. C. Mangelsdorf, *Proc. Nat. Acad. Sci. U.S.* **56**, 370 (1966).
7. J. R. Platt, *The Road to Man* (Wiley, New York, 1966) [originally published in *Science* **149**, 607 (1965)].
8. Estimates published by the Food and Agriculture Organization show a continued increase in rice yields up until 1963–64, followed by successive declines in each of the three following seasons; see annual issues of *Production Yearbook* (Rome) and *Monthly Bull. Agr. Economics Statistics* **15**, No. 12, 26 (1966).
9. *Japanese Import Requirement: Projections of Agricultural Supply and Demand for 1965, 1970 and 1975* (Institute of Agricultural Economic Research, University of Tokyo, 1964), p. 84.
10. Soybeans cannot be commercially hybridized and show only limited response to nitrogen: see *The World Food Problem* (Government Printing Office, Washington, D.C., 1967), vol. 2, p. 197.
11. J. Bonner, *Science* **137**, 11 (1962).
12. *The Plant Sciences Now and in the Coming Decade* (National Academy of Sciences, Washington, D.C., 1966), p. iv.
13. A detailed discussion of the technical problems and issues faced in intensifying plant production in the developing nations is presented in *The World Food Problem* (Superintendent of Documents, Government Printing Office, Washington, D.C., 1967), pp. 215-233.
14. The minimum wage was recently raised to $1.40 per hour.

15. I am indebted to Dana G. Dalrymple of the U.S. Department of Agriculture for his suggestions and assistance.

NEWS AND COMMENT

NIH: Fountain Committee Issues Bitter Attack on Programs

In one of the bitterest critiques a congressional group has ever directed at a federal research agency, the House Government Operations Committee has charged the National Institutes of Health with a thick catalog of failures, ranging from "weak and ineffective central management" to administrative procedures that are "irresponsible, unscientific and contrary to the best interests of the academic community and the government." It has questioned the quality of research supported by NIH, has accused the agency of favoritism in the distribution of money, and has revived the charge that NIH is single-mindedly overfeeding research to the detriment of teaching and medical services.

These allegations were made on 22 October by the Committee's intergovernmental relations subcommittee, chaired by Representative L. H. Fountain (D–N.C.), who, since 1959, has been scrutinizing the affairs of NIH with a constancy, intensity, and, at times, hostility that are unique in congressional dealings with scientific affairs.

Despite nearly a decade of Fountain's surveillance, NIH has, in a sense, flourished, its budget having risen from $430 million in 1960 to over $1.1 billion this year. But, though the effects of Fountain's criticisms cannot be precisely measured, there is no doubt that the congressman has contributed significantly to effecting (i) a decline in NIH's financial rate of growth and (ii) the burgeoning of a paperwork thicket between the agency and its grantees. For, since Fountain started riding herd on NIH, the main consequence of his diligent diggings has been twofold: to help persuade his congressional colleagues that NIH has grown much too fast, and to persuade NIH that, in trying to reconcile science's free-form administrative ways with government's insistence upon precise accountability, it had better come out on the side of government.

In his dealings with NIH, Fountain has evolved a relatively simple and highly effective technique. With the threat of subpoena power giving his subcommittee access to virtually every bit of paper in NIH's files, his formidable staffman, Delphis C. Goldberg, who holds a Harvard Ph.D. in political economy and government, untiringly pores over the records; departures from prescribed form are carefully culled, and then a case—well documented and often damaging—is put together to support the contention that NIH is functioning as something of an extra-legal rogue in the federal hierarchy. Easily lost in the shouting and the ensuing shock is NIH's defense that Fountain is ascribing universality to a few departures from the rule book, and that, in any event, the scientific and medical success of NIH's billion-dollar operation should be the measure of performance, rather than NIH's score in abiding by every curlicue of administrative procedure.

Fountain's latest product, titled "The Administration of Research Grants in the Public Health Service,"* is far and away the most damaging of the three reports he has issued on NIH since 1961. And, in the absence so far of any formal response or explanation from NIH, it appears that Fountain and Goldberg have dredged up at least one

* Available without charge from the House Government Operations Committee, Rayburn Building, Washington, D.C.

major episode that makes NIH look very bad indeed. This has to do with the implementation of the NIH program known as the Health Science Advancement Award (HSAA), which was established for "developing new and strengthening existing health science activities." Often referred to as a "centers of excellence program" on the style of NSF's science development program, HSAA at least gave the appearance of being intended as a developmental program designed to assist second-rank institutions that lack only a fiscal boost to put them on the road to significant improvement. As such, HSAA was responsive to congressional pressures and a presidential directive of September 1965 for broader distribution of federal research funds, but, as Fountain spells it out in a carefully documented account, some curious dealings took place before the world at large was ever told of the HSAA program.

NIH Meetings

Though the program was publicly announced on 22 April 1966, with deadline for applications set for 15 July 1966, the fact is, the subcommittee reports, that, as far back as late April *1965*, NIH staff members met with representatives of Cornell University, the University of Virginia School of Medicine, and the Graduate Research Center of the Southwest to discuss the submission of HSAA applications from these institutions. Citing an NIH "Memorandum of Meetings," dated 1 May 1965, the subcommittee reports that "at these meetings 'each of the institutional representatives agreed that the suggestions made would be considered in redrafting their proposals' and that a draft from each of the institutions would be in NIH hands in 2 weeks." On 1 June 1965, the report continues, an ad hoc HSAA scientific advisory committee met at NIH to review the applications. Fountain's report does not identify the members of this ad hoc body, but, quoting from transcripts of their sessions, it reveals the following conversations:

> Committee Member: . . . We have only three applications. The program wasn't announced, and I don't know what the mechanism was for getting these three applications into the hopper. . . .
> NIH Official: It was suggested to them, each and every one, that they apply, at least by some official in the Public Health Service. . . . This was a trial balloon. . . . This isn't accidental, and we will not open the floodgates. This is not a program in which 50 institutions can apply no matter who or how distinguished they may be. . . . We are fumbling around here. What we do not want to be is flooded under with 15 applications or 50 or something.

The subcommittee reports that the ad hoc body approved the applications, which were then presented to the National Advisory Health Council on 8 June 1965—11 months before public announcement was made of the HSAA program. (By law, all NIH grants must be approved by an appropriate advisory health council.)

According to a transcript of the Advisory Council deliberations, one member stated, "We are sort of in the position of judging a beauty contest with not enough applicants." Another later said, "I think that when public funds are involved . . . there is a clear obligation on the part of the Federal Government to announce in clear and explicit terms to all interested parties the terms of the competition. . . . And I feel very strongly that this principle ought to be established. . . . And I think that if this is done, that we will find . . . a number of candidates and some of them may be even more lovely than what has gone on before."

Decision was postponed to the 28 September 1965 meeting of the Advisory Council, when the Cornell and Virginia applications were approved; action on the application of the Graduate Research Center of the Southwest was deferred, and later the Center's application was withdrawn following the suggestion that funds be sought elsewhere at NIH. But, in the meantime, the ad hoc committee had approved an application from Michigan State University, and this application was also ratified by the Council. (Later, however, the MSU application was transferred for funding under another NIH program.) This left Cornell and Virginia as the only schools certified for HSAA grants.

At this same September meeting of the Advisory Council, the Fountain report continues, "concern was voiced . . . over the non-competitive nature of the applications in the absence of a public announcement." The response given at that meeting apparently indicates the defense that NIH has in mind for the procedures that were followed: As the Fountain report puts it, presumably on the basis of transcripts of the Council meetings, the expression of concern was followed by the "NIH Director's assurance that the agency had ample precedent in that it has used this non-competitive approach in the past to initiate a number of other programs. The Council was told that the purpose of this approach was to negotiate with a limited number of schools in order to develop the rules and regulations for the program which would then be extended to a large number of institutions."

Final approval of the Cornell and Virginia applications was given by the Council in September 1965, with a decision that each would receive approximately $1 million over a 5-year period, starting in 1966. Though the Council members went along with this program procedure, at least some of them remained disturbed by the selection process, for at a meeting on 22 March 1966—still a month before HSAA was to be publicly announced—one member stated:

> . . . It is hardly surprising that the Review Committee found much good in these proposals, but I would argue that they would have found much good in proposals from other large, prosperous institutions throughout the country had those institutions had the opportunity to know about the availability of Federal funds. I am even tired of my own speech on this, I have made it so often.

Referring to a Ford Foundation grant of $4.4 million for biological sciences programs at Cornell, this same member went on to say:

> Obviously, Cornell is a fine institution. Witness the fact that the Ford Foundation is willing to put a large sum of money into it. The question that confronts us is whether in the light of the large grant from the Ford Foundation this becomes the best expenditure of Federal funds, funds that are extremely limited.

The Fountain report goes on to relate that, after the HSAA program was publicly announced, NIH received summary proposals from 128 institutions. Of these institutions, 15 were invited to submit detailed applications. Nine of these 15, it continues, had previously received NSF science development grants. (Virginia was also a recipient of one of these NSF grants, for $3.78 million, but the report points out that the NSF grant to Virginia was intended for a new graduate school of Arts and Sciences, and that the NSF money complemented rather than duplicated the HSAA award to the medical school.) Out of the 15 finalists, NIH picked five for HSAA awards—the University of Colorado, the University of Oregon, Purdue University, Vanderbilt University, and Washington University.

When an "illustrious university" queried NIH as to why its HSAA ap-

plication was rejected, it was advised, the subcommittee reports, that since it "is already a generally distinguished university in the Nation, with a high concentration of faculty talent, it would be inappropriate to use limited Health Science Advancement Award funds to further strengthen the departments of anatomy, physiology, and pathology in the medical school, and biological science departments of the school of the humanities and science in your institution. It was felt that support from this program would fail in its relative impact in stimulating excellence in biomedical training and research in the Nation, and for that reason the summary proposal was declined for further consideration.

"We trust," the NIH reply continued, "that your goal of strengthening the entire biological community at [name of institution deleted] may be realized, but we cannot support your application at this time."

Asserting that the procedures employed in starting the HSAA program were "irresponsible, unscientific, and contrary to the best interests of the academic community and the Government," the subcommittee report declares, "It is incomprehensible that NIH should be 'fumbling around,' as one of its own officials expressed it, when awarding substantial amounts of public money without first formulating a mature and defensible plan for a new program."

Contending that the HSAA program was brought into existence without proper legal authority (though this seems to be disputed by a ruling that the General Accounting Office furnished last June to the General Counsel of the Department of Health, Education, and Welfare), the Fountain report demands that NIH suspend further HSAA grants until legislative authorization is obtained.

The assault on the handling of the HSAA program is the most powerful in the subcommittee report, but other matters are also torn into with great force and great documentation from NIH's own files. For example, the report notes that last year NIH substituted a single cost-sharing grant, totaling $22.6 million over 5 years, to encompass 41 grants and three contracts that had been awarded to the Sloan-Kettering Institute for Cancer Research. This comprehensive award was made as part of NIH's effort to disentangle itself from trying to administer a nationwide program of some 15,000 sep-

NEWS IN BRIEF

● **VOYAGER PLANS UPSET**: The National Aeronautics and Space Administration last week gave up all hope of a 1973 Voyager mission to Mars when Congress failed to provide money specifically for this mission. House-Senate conferees on the space appropriations bill said NASA could seek its permission to take funds intended for other programs and "reprogram" them for Voyager. A NASA spokesman said, however, that a "1973 Voyager launch [for either an orbiter or lander mission] is definitely out." This means that the earliest Voyager-class mission to Mars would be at the 1975 launch opportunity. A Mars flyby mission with a Mariner spacecraft is planned for 1969. But a 1971 Mariner mission, to have included a probe of the Martian atmosphere, was an earlier victim of the budget-cutters. The chief reasons for denying funds for Voyager: Vietnam and the budget squeeze.

● **BRITISH BRAIN DRAIN**: Britain is faced with an accelerating emigration of young scientists, engineers, and technologists that constitutes a threat to its national interests, a special committee has reported to the British government. The report, entitled *Brain Drain*, stated that emigration nearly doubled between 1961, when 1900 engineers and 1300 scientists left Britain, and 1966 which saw 4200 engineers and 2000 scientists leave. Migration to North America quadrupled during that period. According to the report, most of the emigrants were in their late twenties and most were recent university graduates. The committee estimated that individual training had cost the nation between $16,000 for a bachelor of science or engineering to $45,000 for a Ph.D. in physics. To stem the drain of scientific manpower, the committee urged "the creation in this country of the sort of industrial and intellectual atmosphere which we believe to be the only effective solution to the brain drain." Specific recommendations advocated more challenging jobs in industry, higher pay, government financial incentives, and a better national appreciation of the role of the industrial scientist and engineer. The committee found that higher wages in the United States were only one of the incentives that attracted the talented young. Others included massive technical programs, such as space, and the higher status enjoyed by scientists in American society.

● **STUDENT DEMONSTRATIONS**: Recruiters from the Dow Chemical Company, a manufacturer of napalm, have been the target of demonstrations on several campuses throughout the nation in recent weeks. Students picketed Dow recruiters and staged a sit-in at the University of Illinois in Champaign; at the University of Wisconsin, Milwaukee, 71 persons were injured when police were called out to clear a sit-in staged against Dow interviewers. At Harvard, students held a Dow recruiter captive in a conference room for 9 hours. University of Minnesota students fasted in protest against Dow recruiters. At other colleges, students demonstrated against Navy recruiters and defense-connected university projects. Students imprisoned a Navy recruiter 4 hours in his car at Oberlin College in Ohio. Brooklyn College students also protested against Navy recruiters. Thirty students were arrested at Princeton University for blocking a campus military research center that is affiliated with the Institute for Defense Analyses. At the University of Michigan, the student newspaper urged the university to withdraw from a $1.5-million classified counter insurgency project in Thailand.

● **AID FOR NEGRO COLLEGES**: Thirty colleges with predominantly Negro enrollments are eligible for $1 million in matching funds from an incentive grant designed to stimulate their private fund raising efforts. Eligible colleges are members of the Cooperative College Development Program (CCDP), a project of the Phelps-Stokes Fund that is partially financed by the Alfred P. Sloan Foundation. Sloan has allocated $1 million to match contributions from the colleges' alumni on a dollar-for-dollar basis; contributions from within each college's state, $1 for $2. On that basis, each college is eligible for $30,000. An additional $100,000 is being reserved for incentive awards for the top four colleges in specific fund raising categories. A similar $1 million grant was offered by the Sloan Foundation to CCDP members 2 years ago.

arate grants. But the Fountain report takes the position that, as a result of this procedure, a large sum of research support is excluded from competition and outside review. Further, it observes that while Sloan-Kettering is "widely recognized as a leading cancer research institution," it has far from a perfect batting average in obtaining approval for its grant applications at NIH. "In the last two complete fiscal years which preceded the January 1966 single grant," the subcommittee states, "Sloan-Kettering investigators applied for 34 separate grants, of which only 20 were approved by NIH's scientific review bodies. The approval rate for these applications was 59 percent in the combined fiscal year 1964 and 1965. The comparable approval rate for all NIH applicants in these same years was 58 percent."

On the issue of the scientific quality of all NIH-supported research, the report notes that, in 1956, 40 percent of NIH grant applications were placed in the topmost evaluation category, whereas in 1966 only 26 percent were judged to be at this level. NIH, of course, can reply that awards, rather than evaluations, are a significant measure of quality, since not all approved applications actually end up with NIH money. And, on the basis of awards, the quality—to the extent that it can be meaningfully measured—holds up well. Further, the 1966 program was five times the size of the earlier effort, and is at least tacitly predicated on the assumption that possibly pedestrian projects have a part to play in a vast nationwide program of biomedical research. Also, NIH can point out that in recent years it has emerged with high honors for scientific quality in a variety of outside evaluations.

But the dilemma of NIH as well as of other scientific agencies lies today more in the substance of politics than in the substance of science.

At least in the case of the HSAA program, there is the appearance—a solid appearance, it must be added—that NIH engaged in some highly questionable administrative procedures. The motives may have been good science, but the appearance is awful, and with Congress now rampaging about federal spending in general, and research expenditures in particular, this is an unfortunate time for the mainstay of biomedical research to be exposed to accusations of dubious practices.

NIH has not yet come forth with a public explanation. Its relations with Fountain and his staff are so chilly and distant that there is little communication between the congressman's office and Bethesda, outside of Fountain's demands for papers and NIH's acquiescence. The gist of the report is not drawn from any recent hearings. No hearings were held, except for two sessions in June 1965, when Fountain belabored NIH for paying overhead fees in excess of the required minimums. In fact, the hostility between Fountain and NIH is now so great that, at the time the report came off the press last month, NIH was totally unaware that it was even in the works.

—D. S. GREENBERG

Mt. Sinai: How a Hospital Builds a Medical School

New York. Since its founding in 1852 by Jewish immigrants, Mt. Sinai Hospital has moved its home twice and changed its name once. Its 22-building medical complex now fits snugly between 98th and 101st Streets on Manhattan's East Side, where 5th Avenue's fashionable apartments quickly run into the slums of Harlem. The hospital treats 150,000 patients a year, delivers 5000 babies, and is indisputably one of the nation's best. But it is not satisfied; it is beginning a medical school.

Along with 15 other new medical schools, Mt. Sinai enters the well-documented world of the doctor shortage. Yet, even with these new openings, American universities will not produce enough physicians, or, for that matter, meet the demands of college graduates who want to become physicians. Many educators have shied away from starting medical schools because they know what Sinai's founding so amply illustrates: that creating a medical school is a long, costly, and intellectually demanding business that may be the most diffcult undertaking a university can attempt.

When the first students enter Sinai next year, nearly a decade will have passed since the hospital's leaders started thinking seriously about a medical school. The Admissions Office will accept 25 first-year students, but will have to wait at least three more years—until 1971 when the school's major building is completed—before accepting the first full-size class of 100. The initial investment to create the school is estimated at $107 million, a figure that is probably conservative.

Nevertheless, in many respects, Sinai has had an easier time than many other developing medical schools. The hospital starts with impressive assets. It has a long tradition of clinical excellence and a high-quality staff, which, because Sinai continually attracts first-class interns and residents, has plenty of teaching experience. Thus, unlike most medical schools, it did not have to find, build, or improve a hospital in which to train its students. In addition, Sinai always encouraged research and an atmosphere of inquiry. "There were 78 medical schools in the country in the 1950's," says hospital director Martin Steinberg, "yet without being a medical school, we were 27th in the amount of money received from NIH. . . . This is how hard we worked on this area."

Because of these strengths, Sinai also has a widespread reputation for quality, which is an undoubted asset for recruiting a faculty and raising money. And Sinai has also had time to ponder carefully what kind of medical school it wants to build. "We are in a better position to experiment with medical education because we don't have to worry so much about patient care and research," explains Hans Popper, a