newspaper advertisements that Scientists and Engineers for Johnson ran in his behalf, and even complained to party officials that one such advertisement, in the New York *Times*, failed to mention his name often enough. And, again, according to party leaders, it was Johnson who suggested that Scientists and Engineers for Johnson employ spot radio announcements in his behalf.

"Shockingly Irresponsible"

These may well have been in the works before the President suggested them, but in any event they were potent stuff. Featuring Wiesner, Urey, Spock, Raborn, and York, these spot announcements consisted of a series of statements of support for Johnson and denunciations of Goldwater. They were broadcast some 3000 times throughout the country. On one tape, Urey said that "many Goldwater statements regarding the use of nuclear weapons are shockingly irresponsible." And in another, Spock, introduced as the "famous child care expert," said, "I don't see how any parent who is serious about the education and happiness of his children can do other than vote for President Johnson and Senator Humphrey." (Inez Robb, the newspaper columnist, later quipped that Spock's appearance in the campaign marked "the exact moment at which all hope for victory oozed away from the Republican candidate. . . . Millions of mothers and grandmothers in the United States," she wrote, "would as soon question Dr. Spock as they would Holy Writ.")

Thus, with Johnson taking a personal interest, and the scientists and engineers flocking to their well-organized local chapters to seek campaign duties, the organization prospered, and expanded to fill the campaign role carved out for it.

Clearly, a large part of the story of Scientists and Engineers for Johnson can be summed up as expert cultivation on fertile soil.

Does the experience of the past campaign mean that scientists and engineers are in the process of emerging as a well-defined political force in national elective politics? The available evidence and the judgments of many of those who were centrally involved in Scientists and Engineers for Johnson suggest a negative answer. But, at the same time, as one scientist put it, "having tasted political blood, we'll never be the same."

Perhaps the most important thing to be said about the genesis of Scientists and Engineers for Johnson was that it developed in response to a particular political circumstance: the candidacy of Barry Goldwater. If the Republican candidate had been William Scranton, Richard Nixon, or Nelson Rockefeller, it is improbable that the leadership or the rank and file of the scientific and engineering communities could have been so easily mustered in behalf of Johnson. Repeatedly one was told that the organization should have been called Scientists and Engineers Against Goldwater. Anti-Goldwaterism was, in fact, so clearly the only unifying basis for the organization that Washington headquarters and the state chapters recognized at the outset that it was mandatory to stay away from local and state issues. And, unless a future campaign presents a presidential candidate so far from the political center as Barry Goldwater, it is improbable that large segments of the scientific and engineering communities can be rallied as they were for the 1964 campaign.

But going farther afield into speculation, the fact is that lots of scientists who were once apolitical have indeed tasted the heady stuff of politics, and they have found that they can be effective. Though their thoughts do not yet seem to be fully clarified, a number of them—especially some younger people in California and Massachusetts—hope that some portion of Scientists and Engineers for Johnson can be preserved to function as a sort of political action organization. But most members seem to be indifferent to this interest, and a good number are actively opposed, for a variety of reasons: that many Republicans were brought into the organization with the understanding that it was a one-shot affair conceived in response to Goldwater; that the scientific and engineering communities will tarnish their public prestige by regular involvement in national politics; and that professional societies and regular party organizations are the appropriate channels for scientists and engineers interested in affecting public matters.

Regional Lobbying

Nevertheless, it is difficult to believe that the intense activity of the last campaign is not going to leave some political progeny. Future campaigns may well see a kind of escalation producing science and engineering groups on both sides. Scientists and Engineers for Johnson did not in any way function as a political lobby for science and engineering—possibly because these professions can't really gripe very much about the way the federal government has treated them. But it is possible that the tightening of federal funds for research and development may turn thoughts toward the sort of collective political action that worked so well in the last campaign. Clearly, the scientific and engineering communities are too distinct from each other, and each is too diffused throughout the country, for them to reenact their 1964 performance for bread-and-butter goals. But there are common regional interests—such as the location of federal research facilities—that could provide the basis for political action on a less-than-national scale.

In any case, more than 50,000 scientists, engineers, and physicians have just passed through an exciting and successful political baptism. It is not likely that they are going to consider that experience to be irrelevant to their future professional and political concerns.—D. S. GREENBERG

(This concludes a series on scientists and engineers in the presidential campaign.)

Centers of Excellence: New NSF Science Development Program Aims at "Second 20" Universities

The phrase "centers of excellence" has acquired, in the last few years, a special meaning for a group of American universities which are neither the best nor the worst, but aspire to a more favorable place in the academic sun.

Excellence in universities is difficult to define and even more difficult to measure. But the existence of a quality hierarchy, as it is sometimes called, among universities is one of the important facts of life in higher education today, and there is general agreement within the university community as to which institutions rank at the top. These universities tend to pay the highest salaries, boast the most celebrated faculty members, attract the better undergraduate and graduate students, and award the most Ph.D.'s.

Since World War II, a major index of status has been the volume of federal funds for scientific research which an institution attracts. The basic federal policy of directing funds to the institutions deemed most capable of performing the desired research has resulted in a concentration of funds in a relatively few institutions, with the effect,

say critics, of making the rich inevitably richer.

In recent years pressure to admit more institutions into the charmed circle has mounted. More scientists and engineers, it is argued, are needed to guarantee economic growth and national security. And in the last few years a tinge of regional politics has been injected into the discussion as the importance of strong university research capabilities to a region's economy has been publicized. What, in essence, is being sought is federal help in expanding research and graduate education in universities which have been less than distinguished in these things.

A bench mark in any discussion of efforts to increase the number of major university research centers is the so-called "Seaborg report," published in 1959 by the panel on basic research and graduate education of the President's Science Advisory Committee. Glenn T. Seaborg, now chairman of the Atomic Energy Commission but then chancellor of the University of California, Berkeley, headed the panel which produced the report, titled *Scientific Progress, the Universities, and the Federal Government.* The panel's assumption that the advancement of science depends on basic research and that basic research and graduate teaching are inseparably linked was not startling. But what was regarded as new and significant in the report was the panel's strong affirmation that graduate education needs "flexible reinforcement," and a recommendation that "over the next fifteen years the United States should seek to double the number of universities doing excellent work in graduate education."

The report was interpreted as a call for the elevation of a "second 20" into the league to which the top 20 belong, and it was received with special delight in those universities which saw themselves as potential new centers of excellence.

It is assumed that substantial new federal funds would be required to foster these new centers, and this would require a modification of the system of government support for research which has prevailed since World War II. National competition has been the key concept, with contracts and grants and fellowships awarded the individuals considered to be the most capable. The judging has been done not by federal bureaucrats but by committees comprised of active researchers.

The agencies have sought ways to help able men in the less illustrious institutions, and many panels have taken pains to encourage ability wherever it is found. But the pattern of awards in the past has clearly reflected a heavy flow of research funds into the institutions in the upper reaches of the quality hierarchy. In 1962, for example, an estimated 90 percent of federal research funds was concentrated in 100 institutions, 59 percent in 25 institutions, and 38 percent in only ten universities.

The top ten that year were (in this order): University of California, Berkeley; M.I.T.; Columbia; University of Michigan; Harvard; University of Illinois; Stanford; University of Chicago; University of Minnesota; and Cornell.

It has been apparent for some time that if the federal government is to give effective help to less developed universities, ways will have to be found to help institutions as well as individuals.

Congress took a direct hand in 1958 when it included in the National Defense Education Act a graduate fellowship section designed, among other things, to promote a wider geographic distribution of graduate facilities. NDEA fellowships were to be granted only in new or expanded graduate departments. More significant, the law specified that the fellowships were not to be given directly to graduate students, who tended to congregate in a few institutions, but were to be awarded through participating institutions themselves and to be tenable only at those institutions.

An older example of the same sort of program is provided by the "indirect" traineeships financed by the National Institutes of Health. These are stipends paid graduate students from funds granted an institution to establish, expand, or otherwise improve its training facilities in the health professions. Many competent researchers in institutions lacking resources to give them adequate support have been helped by the NIH "research career program." (*Science*, 18 Sept. 1964)

Institutional Grants

NIH also has a broader institutional grant program—the general research support program—a continuing program for nonprofit institutions engaged in health research. According to a foreword in a pamphlet describing them, these grants are designed to give institutions "an increased measure of control over the quality, content, emphasis, and direction of their research activities. It permits them to meet emerging opportunities in research, to explore new and unorthodox ideas, recognize and support scientific talent earlier, and in general, to utilize funds flexibly and in ways that will be catalytic for fostering additional research capabilities and for attracting additional means of research support."

The size of each grant is computed on the basis of a formula which takes into account the total amount of health-related research being done in the institution and the total federal and nonfederal funds annually, up to $2 million, for health-related research. The maximum amount currently available under the formula is about $318,000, including the usual 20 percent for overhead. Each eligible educational institution, no matter what its entitlement under the formula, is guaranteed a base grant—now $25,000—"to insure that it will have a minimum financial base for a research and training program."

The National Science Foundation has also operated an institutional grants program since 1961. Funds are distributed according to a formula which takes into account NSF funds expended for science education as well as for research. In 1963 nearly 400 institutions shared institutional grants totaling $7.6 million.

A much more selective kind of encouragement to aspiring universities is embodied in a new NSF program designed to foster development of additional centers of high-quality research. Called the "science development program for colleges and universities," the first money for the plan was authorized in fiscal 1964, when $3 million was appropriated. Congress is suspicious of requests for science funds which are not to be used directly for specific research projects, but the attractiveness of the idea of helping second-line universities to improve can be judged by its acceptance in a year when NSF saw about $100 million cut from its budget request.

Congress allowed another $25 million for the science development program for the current year. No grants have yet been made, and NSF officials have been proceeding carefully with one cautious eye on Congress and the other on its avidly interested higher-education constituency.

In shaping the new program, NSF has clearly drawn on the experience of the private foundations, as federal agen-

cies often have in the past when venturing on new programs.

The foundations pioneered both the "project grant" and the support of individual investigators, and also broader institutional support. The General Education Board's channeling of Carnegie money into college endowments early in the century and the flow of Rockefeller funds into the improvement of medical schools in the 1910's and 1920's were notable examples of general support programs.

Growing demands on foundation resources dictated a retreat from general support programs after World War I, and most foundation funds were used to support individual researchers or were parceled out as "seed money" to underwrite promising innovations. Creation of a new superfoundation based on the Ford family fortune after World War II, however, made possible a new chapter in the general support of universities.

Late in the 1950's the Ford Foundation evolved its "special program" of institutional grants. The stated aim of this program is to strengthen higher education in different areas of the country. Grants are made to the institution as a whole in the hope that the money will help the institution to reach and sustain a significantly higher level of academic excellence.

From the first, there had been talk within the Ford Foundation about encouraging "peaks of excellence" in higher education. The special program, however, seems to have developed out of the special interest of Henry Heald, former chancellor of New York University, who became president of the Ford Foundation in 1956.

The first grants under the Ford special program in 1960 went to five universities, diverse in character and dispersed in location—the University of Denver, Johns Hopkins, Notre Dame, Stanford, and Vanderbilt. The total amount of the grants was $39.9 million, of which $23 million went to Stanford. (Public universities and colleges have been excluded from the program because the foundation decided that to include them might relieve legislatures of the responsibility of developing these institutions.) Since the initial grants were made, ten universities have received a total of $109 million in Ford funds and 47 colleges, a total of $97 million. Matching funds raised by the institutions under terms of the grants come to more than a half billion dollars.

The special program has been based on the matching of foundation funds on a 2-to-1 or 3-to-1 basis by the participating colleges and universities, and so far no institution has failed to raise the sums required.

Ground rules set up for the special program by the foundation have required not only exhaustive financial and statistical background reports on the institution but the submission of well-developed plans for future development. Foundation officials insist that they are not trying to influence university planning in any particular direction, but simply seek to make certain that the institution has a clear idea of the ends it wants to pursue and will have the means to have a fair chance of succeeding.

Sound planning and geographical spread, then, are emphasized in the selection of institutions for the special program. Other criteria, in addition to the requirement that participating schools be independent, are that they be racially integrated, have first-rate leadership and a tradition of sound scholarship, and show a record of substantial financial support which indicates that the grantee will be able to carry on at a higher level when the foundation money stops coming in.

Under the Ford program, colleges have been included primarily out of concern for the future of the liberal arts college, and several of the colleges generally recognized as in the top category have been given grants.

The new NSF science development program resembles the Ford "challenge grant" program, but there are important differences. A private foundation has a freedom of action in giving grants to selected universities which a federal agency does not have, and the NSF program is the result of a long discussion in which Congress, the universities, and NSF all figured.

Surveying the Field

A proposal to help increase the number of centers of excellence by having NSF underwrite professorships in the sciences was abandoned, apparently under pressure from leading universities who may have envisioned their top faculty being lured away. Attention then shifted to the device of institutional grants, and a high-level committee headed by NSF associate director for research Randall M. Robertson launched a study of a dozen widely distributed and quite different universities including the University of Louisville, University of Maryland, Stanford, University of Colorado, Western Reserve and Case Institute of Technology, and Fisk.

Results of this study showed that universities needed help in three major areas: (i) upgrading and retraining of faculty, (ii) improvement of equipment and facilities (from minor repairs to the construction of accelerators), and (iii) buildings.

In 1963, NSF approached Congress with the idea of the science development grants. These plans were approved, and then the much bigger appropriation was provided for the current fiscal year. NSF first drew up detailed criteria for the information of applicants for support under the new program and then scrapped these for a very general announcement which appeared early this year. From March to September more than 200 institutions sent representatives to inquire about the program. Formal application, however, requires the submission of a lot of information and, as in the case of the Ford challenge grant, a carefully constructed plan for development, and the applications have just begun to come in.

The key words in NSF director Leland H. Haworth's foreword to the announcement are these: "by assisting institutions of higher education in the realization of their own plans for strengthening science and engineering efforts, the Foundation can contribute significantly to the increase in the number of outstanding colleges and universities in the country."

According to the NSF announcement, grants will go to institutions judged to have the greatest possibility of moving to a higher level of scientific quality and to have sound plans for maintaining this quality.

Institutions already recognized as strong academic centers in science are advised to continue to depend on existing programs. At the other end of the scale, it is made clear that this is not to be a rags-to-riches program and that important criteria will be, (i) the presence of sufficient scientific strength at the institution to serve as a base for the proposed development plan, and (ii) the availability of adequate financial resources to give reasonable assurances that the institution's goals—as stated in the proposal—can be achieved and maintained.

No specific requirement for matching NSF funds is included in the terms of the grants, but NSF officials make it clear that participating institutions will have to have firm prospects of new

financial support, not only to supplement federal funds but, ultimately, to replace them.

Because the funds will be given selectively, the method to be used in choosing the recipient institutions has naturally intrigued university administrators. The mechanism is really quite similar to NSF apparatus for distributing other kinds of grants. Basic staff work is done by NSF personnel, and final approval of grants is to be given the National Science Board. The key task of recommending which institutions be given priorities among the list of those eligible—many more are expected to be called than chosen—will be performed by a scientific committee made up of distinguished private citizens selected for their knowledgeability and disinterestedness. The recently announced members of this committee are Carl W. Borgmann, Ford Foundation; Robert R. Brode, University of California, Berkeley; Dale R. Corson, Cornell; Colgate W. Darden, Jr., Norfolk, Virginia; James D. Ebert, Carnegie Institution of Washington; William B. Harrell, University of Chicago; Lyle H. Lanier, University of Illinois; and John R. Pierce, Bell Telephone Laboratories.

The presence on the panel of representatives from the "top 20" institutions serves notice that these institutions should not expect to participate in the program. The committee is scheduled to hold its first meeting in late January and make its first recommendations in time for the National Science Board to act at its March meeting. It is understood that the maximum for grants will be $5 million.

If the history of the Ford challenge grants is any criterion, a major benefit of the new NSF program to every institution which applies, whether successfully or not, will be the experience of taking stock of its situation and thinking systematically about its future, salutary activities in which universities don't overindulge.

As for what criteria will be applied in selecting among universities which see themselves in an in-between category, NSF director Haworth gave some hints last May in testimony before the House Science and Astronautics Committee's subcommittee on science, research, and development.

Said Haworth, "Well, it is a combination, of course, of a lot of things. Very important is leadership. Leadership at the university level, and leadership at the departmental and school level, the desire to improve, the backing of the public through legislation and so forth if it is a public institution, and of its governing board, in matters such as income.

"But I think the two most important things are desire and leadership.

"Then, of course, little kernels of competence, existing competence, are important. Beginning right after the war, when we wanted to get results, we went to the very best places to get research and development done. We have been broadening our base all this time. There are many more good places now than there were 15 years ago. Just as we went at that time to the best places for immediate results on research, then tried to build up greater competency in more places, we will go next to the newer centers of competence.

"It is very encouraging to me to talk to the university administrators. I have talked to a large number of the leaders of places that would not be mentioned in the magic first 20, or whatever the number is that is talked about so often, who are really on fire to improve their situations, who have ambitious plans, who are getting local support—and by 'local' I mean from their State government if it is a State institution, or private sources if it is not—and who really see that it is important to them and it is important to the country that these places develop. They are scattered all over the country, and there is a great deal of desire and real earnest effort being put in. I think it is very encouraging."

It should be remembered that NSF has talked about geographical distribution in only the most general way and has certainly made no commitment to any sort of regional equalization policy in distributing the grants. Creation of new centers of excellence and an even geographical distribution of funds are by no means necessarily compatible. Given the limitation on funds and the condition of universities in some areas, a policy of fair shares for all in creating new centers of excellence would be as efficacious as carrying through Solomon's suggestion of cutting the disputed baby in half.

This is not to say that the federal government regards some institutions as outcasts. The new higher-education facilities act, for example, provides for distribution of funds through state authorities to both public and private institutions on the basis of population, and there is strong pressure within Congress for a "formula distribution" of any new funds.

"Scatteration," as it has been called, however, does not seem a real threat to the research grant system. The edifice of federal support for science is founded on the principle of the purchase of services by mission-oriented agencies in pursuit of their missions. The National Science Foundation has a somewhat more flexible policy than other agencies because of its responsibility for science education as well as research, but the rise of the institutional grant does not foreshadow the decline of the project system. As Haworth said at the hearings last May, "I think our regular programs must continue to use quality as the primary criterion. For one thing we get better results that way. For another thing we must not allow the places that are already good to deteriorate. That would be disastrous."

The federal grant system, however, is obviously undergoing a period of adjustment. The institutional grant can be viewed as a product of the fundamental tension in the government-university relationship created by the demand on the part of the universities for federal aid with the fewest possible strings attached, and by the agencies' insistence on a full accounting and fair return on the taxpayers' money. The search for mutually desirable financial arrangements will continue, and it is reasonable to predict that, if the federal government is to succeed in helping to create new centers of excellence in science, it will be necessary somehow, as the private foundations found, to nurture excellence in whole universities.—JOHN WALSH

Announcements

Howard Simons, science writer for the Washington *Post*, and **Jeremy Bernstein**, associate professor of physics at New York University, have been named to receive the 1964 AAAS-Westinghouse Science Writing Award and $1000 honorariums.

Simons, who was the 1962 recipient, becomes the second person to win the award twice. Simons won this year's newspaper competition for three stories: on Samos satellites, on cybernetics in Russia, and on studies of the planet Jupiter.

Bernstein won the magazine writing prize for his two-part *New Yorker* magazine series titled "The Analytical Engine," describing the history and functioning of computers.

(Continued on page 1622)