position to HEW policy. But I certainly plan to participate."

As a principle, he believes that conflict within organizations is inevitable and that the best way to deal with it is to get it out on the table and face it. (That does not necessarily include the public press.) And, as head of NIH, it is likely he will operate that way. Already, there are some persons who are hoping he does not intend to be *too* frank.

Stone's candidacy for the NIH job cropped up in late April or early May, and the entire process, from first interview to final appointment, took only about 6 weeks. He first came to the attention of HEW and White House recruiters through Merlin K. DuVal, former assistant secretary for health. He was interviewed by Edwards and by undersecretary of HEW Frank Carlucci, who came to that job from the Office of Management and Budget, where he had previously worked with HEW Secretary Caspar Weinberger. Stone saw Weinberger and a White House troubleshooter named John Vickerman. Finally, he met briefly with Richard Nixon on the day his appointment became official. Their conversation was general.

He says he has been given no "instructions" about how to run NIH, that he has no "marching orders." He is reluctant to talk in particulars about what he intends to do because, he says, no one is going to judge him by his intentions, only by his behavior. Thus, anyone who wonders should assume that, because he accepted the job of director of NIH, he supports the institution to which he comes and all that it stands for. But he is not sure what his powers or options as NIH director are, or that they will ever be constant. "As an individual in a role, I suppose I'll continually be testing them," he notes.

This is one of the aspects of Stone's position that the biomedical community is most concerned about. People want to know whether Stone will really be in charge or whether he will have to take orders from above. Stone thinks the situation is, ultimately, far more complex than that and that it is, therefor, an irrelevant question.

—BARBARA J. CULLITON

# Mexico (II): Growing Pains for Science Policy Agency

In 30 years of rapid industrial development, Mexico has thoroughly tasted the power of modern technology, virtually all of which, however, it has had to import at considerable cost from the United States and Europe. Now, driven by a new thirst for some technological power of its own, the Mexican government has undertaken an ambitious campaign to strengthen the country's small research establishment and to tie its activities closer to national economic needs. National pride and some serious economic problems form part, but not all, of the impetus behind this drive (*Science*, 15 June). As a government progress report noted last March, the country urgently needs technical specialists in many fields to "select, absorb, and adapt the technology that we import." At the same time, however, a detectable strain of nationalism is evident. As one government science official expressed it, "We are fighting for our technological independence, and we are far behind in the race."

The central instrument in Mexico's attempt to rationalize and mobilize re-research is the National Council of Science and Technology (Consejo Nacional de Ciencia y Tecnología, or CONACYT). Now 2½ years old, CONACYT has compiled a noteworthy record of accomplishment. It is helping to set up several new applied and basic research institutes around the country; hundreds of graduate students are going to school in Mexico and abroad on new government fellowships administered by CONACYT; the agency has arranged a flurry of joint research and technician-exchange agreements with nations on four continents; and a generally improving research environment has enticed a small but significant number of expatriate scientists and engineers to come home.

In the process, the council's activities have touched nearly every aspect of Mexican science. Not surprisingly, its efforts at reform have aroused tensions and suspicions in a small and fractious research system whose instincts for survival have been keenly honed by years of hardship. In recent months the agency has found itself fending off attacks from the press and the scientific establishment, and it has even caught a lashing from President Luis Echeverría himself. On balance, some of the criticism from the scientific community—focusing on the administration of the agency—seems accurate, although some (including Echeverría's) appears wide of the mark. While it would be overstating the situation to say that Mexico's first real experiment in national science policy is in danger of sinking without a bubble, the sailing is anything but smooth.

CONACYT is not the first agency the government has set up to invigorate research, but qualified U.S. observers in Mexico City generally rate its chances of success considerably higher than the agency's several predecessors dating back to 1935. Uniformly ineffectual, they lacked the budget, staff, and political clout to accomplish much. For example, the main function of the council's immediate progenitor—the National Institute for Scientific Research (Instituto Nacional de la Investigación Científica, or INIC)—was to grant some 200 fellowships a year with a budget that never exceeded $500,000. To its credit, though, INIC did conduct a survey of the state of science in Mexico during 1970 which led to its dissolution and CONACYT's formation.

The new council, in spite of its troubles, is clearly in a different league. Its budget reached $8.7 million last year (almost 8 percent of all R & D expenditures), and there is a good chance that it will double this year. Significantly, CONACYT answers directly to the secretariat of President Echeverría (much as the National Science Foundation is tied to the White House staff), thus giving the council, on paper at least, an unencumbered line of authority to an office even more powerful than the American presidency.

One diplomat in Mexico City calls CONACYT's full-time staff of 540 per-

[R. Gillette]

Historical motifs and a stylized atom appear in murals on the library of the National Autonomous University of Mexico.

sons "one of the brightest pools of talent I've seen here." And, indeed, a visitor to the agency's headquarters, in a small high-rise at the edge of a shaded residential neighborhood, is likely to be impressed with the staff's energy and youth. The place has a beehive quality well into the evening, and key mid-level positions are occupied by a mixture of lawyers, scientists, and engineers who often seem barely into their 30's. Intensely motivated, some shelved promising research careers in local universities, while others left jobs in the United States to try their hands at science policy. "I suppose it seems a little nationalistic," said one official, an engineer who left a partnership in a small Salt Lake City electronics firm to work for the council, "but for years and years I've wanted to come back and do a little something for Mexico's development. This seemed like the opportunity."

The opportunity is clearly there, but events of the past 2½ years, and CONACYT's own continuing diagnosis of the research system, have revealed some formidable problems. Among them are an uneven development of the sciences that has left yawning gaps in the country's research manpower; a scientific establishment splintered into scores of small university and government institutes, with little or no tradition of cooperation; a concentration of R & D talent and money in Mexico City that has left provincial schools woefully handicapped; and a persistent indifference on the part of Mexican industry toward supporting any kind of research.

These sorts of problems are in many respects common to developing nations, particularly in Latin America, where small and underfed science communities have managed to grow since the end of World War II largely in the absence of national science policies and largely without relation to the needs of burgeoning industries. The extent to which Mexico achieves or falls short of its own expectations in enlisting science to the service of development may, in a general way, indicate how much of the rest of the hemisphere will fare.

The 1970 law establishing CONACYT leaves almost no bounds to its responsibilities, although the description of the agency's authority to carry them out is more circumspect. In the first of 27 paragraphs spelling out its duties, CONACYT is charged with advising the entire federal executive branch in all matters of "planning, programming, coordinating, orienting, systematizing, promoting, and channeling activities relating to science and technology, its linkage to national development, and its relationship to foreign affairs." The law goes on to require the council to improve science communications, promote quality control in industry, speed the flow of research equipment through customs, study the weaknesses of research in Mexico, and so on and on.

By far the major activities of CONACYT, absorbing about a third of its budget, are the scholarship and exchange programs for graduate students and technicians. The emphasis here derives in part from Echeverría's strong interest, and in part from a high potential for producing visible results in a short time. There are, nevertheless, genuine and serious bottlenecks in the research system that can be traced to a deficit of specialists in many key areas, ranging from dental research to thermodynamics to computer engineering. Moreover, since the end of the 1960's, overall funding for science has risen from $12,000 per researcher per year to about $20,000 a year, thus relieving some of the pressure for more money and pushing manpower problems to the fore. "In general, I think we're investing enough per head," says Edmundo de Alba, the agency's director of studies and services. "What we need now are more heads."

Under the direction of Emmanuel Méndez Palma, who, only a short time ago was an astrophysicist at the national university CONACYT has put together a crash program that has more than quadrupled the number of government fellowships to 869 in effect as of last February, or about one for every eight Mexican graduate students. About three-fourths have gone to master's degree students and the rest support Ph.D. candidates and postdoctoral fellows; about half the students are studying in Mexican schools and half are scattered in 24 countries, from Japan to Czechoslovakia. As Mendez notes with some justifiable pride, there is hardly a university of note in the world that does not have a Mexican student on its campus.

The technical exchange program has grown at a slower pace, but it is picking up rapidly. Under agreements signed with Japan, Israel, and several European countries, about 350 young

Mexican technicians and engineers have spent a few months in corporate R & D programs, while a like number of foreign students have come to Mexico. Starting this year, the Mexican government expects to send as many as 200 more engineers and technicians abroad as part of a unilateral training program.

While some Mexican analysts question the value of the whole program, what with language and cultural barriers to be overcome, it appears to have strong presidential backing, and CONACYT officials seem convinced of its worth. At the lease, Méndez insists, a few months' contact with a large industrial R & D establishment can give a young man "a more absolute frame of reference, a new calibration system. He can see how others organize themselves, relate to their companies, and he may even learn some new techniques."

Filling Mexico's manpower gaps, however, seems an almost simple and straightforward task in comparison with CONACYT's two other central responsibilities: to purge the research system of duplicated effort by fostering coordination among government and university institutes, and to bring Mexican private enterprise, particularly industry, into the system as an active supporter and user of R & D.

In both areas, however, the council's political leverage is limited. Although by law other federal agencies must consult with it on matters of science and technology, the law doesn't require them to heed CONACYT's advice. In practice, the science agency suffers all the predictable limitations of a new and eager member of the bureaucratic club trying to march a legion of skeptical establishmentarians off in unfamiliar directions.

With the national university, which contains about one-third of the "infrastructure" of Mexican science, CONACYT has even less leverage. Although the university receives 90 percent of its money from the federal government, the autonomy granted it under Mexican law leaves the government with little say on how the money is to be spent. The council's position then is one of friendly persuader. "We are a consulting, coordinating agency, but not exactly in the sense of telling people what they should or should not do," one official explained. "What we can do is to express an opinion on research they might *like* to do."

Enticing Mexican private enterprise into the research system is an equally formidable task. Long accustomed to buying virtually all its know-how from outside the country—in the form of licenses, trademarks, and technical services—domestic industry (companies not affiliated with foreign firms) pays for only about 5 percent of all R & D. One consequence of this indifference has been to leave a striking imbalance in the kind of research conducted in Mexico. According to government officials, about 50 percent of all research is basic in nature while about 35 percent is applied and the rest is counted as "development." Just the opposite pattern prevails in the United States, where twice as much money is spent on applied research as on basic, and private enterprise pays for roughly half of all research.

The council's manpower programs are seen as one means of adjusting the research balance; accordingly, the selection process gives preference to graduates in engineering, agronomy, and other applied sciences as compared with candidates in such "supporting sciences" as physics, mathematics, and chemistry.

The agency's main device for selling industry on the ability of Mexican researchers to solve technical problems and produce marketable ideas is a series of small technical assistance and development programs aimed at small and medium-sized companies. In one such program, CONACYT acts as fund raiser (contributing as little money of its own as possible) and matchmaker, bringing together sometimes half a dozen government and university research groups and a bank or industrial firm to fund a project. (From two dozen projects, this program has already produced some interesting results—including a new process for making rubber from the sap of a gangling desert plant called guayule—of potentially great economic value to some of the country's poorest rural areas.)

In another pilot program, CONACYT staffers have actually gone calling on small companies, soliciting technical questions and problems, then finding someone in a research institute with the answers. In this way, it is hoped, industry will gradually acquire the R & D habit, contracting to existing institutions if they cannot afford to set up their own research divisions.

Apart from possible economic payoffs, council officials feel that these and other programs designed to improve the quality of information services in the sciences will serve the added purpose of knitting together traditionally isolated elements of the research system. Money thus invested is viewed as the most effective lubricant to internal coordination; but money is scarce—CONACYT allotted less than $350,000 to technical assistance programs last year—and this in turn is felt to limit the agency's effectiveness. "You have to achieve cooperation with money here," the head of one of the council's six *centros*, or bureaus, said in a recent interview. "Our experience is that people are very willing to coordinate with us if we help them, and if we can't, they're not interested."

Weaving through almost all of CONACYT's numerous programs and projects is a pattern of special attention for Mexico's 30 or so state universities, scattered from Sonora in the north to Yucatan in the south. This pattern reflects a larger government effort to do what it can to improve the research capability and the quality of teaching in these schools, most of which are small (with a few thousand students) and relatively new (less than 20 years old). The reasoning is that state schools are closest to the country's most pressing economic and social development problems, and the government is also counting on them increasingly to relieve the tremendous pressures for expanded undergraduate and graduate enrollment currently bearing on the two leading, federally supported schools in Mexico City, the national university and the National Polytechnic Institute. The national university alone now caters to 230,000 secondary- and university-level students, of whom 80,000 commute daily to a main campus designed 20 years ago for a third as many students. The student body of the polytechnic institute has passed the 90,000 mark.

Before anything can be done to strengthen the state schools and make them academically more attractive, however, the government must stem what amounts to an internal brain drain from the provinces, which has concentrated 90 percent of the country's R & D talent and money in and around Mexico City. To help counter this flow, CONACYT is weighting its selection of graduate fellows and technical trainees in favor of state-school graduates in the hope that many of them will return home to teach and do research.

As an inducement, the agency is also helping other government agencies to organize several new research institutes of 15 to 20 persons each, to be set up in association with provincial uni-

versities, but with sufficient autonomy to establish ties with Mexico City schools and other potential sources of support. For the most part, the institutes will emphasize regional development problems—one will focus on marine resources and arid land development in Baja California, while another will aid the Veracruz sugar industry on the eastern coast. Still another, 50 miles southeast of Mexico City at Puebla, is concentrating on optics, electronics, and astrophysics.

Setting up the institutes has been a slow process, partly because of the usual money problems and partly because recruiting has gone slowly. Painful past experience, however, suggests that it is just as well not to rush into such things. According to a story told by one Mexican official, a previous attempt to establish a physics institute at the University of Puebla ended in disaster in 1967 when militant students and faculty discovered that the new researchers had been attracted with salaries several times higher than the going rate. Resentment flamed into violence, the laboratory was ransacked, and the physicists departed in some bitterness and haste.

The government seems confident that it can avoid such incidents in the future; the official told the story only to illustrate that science policy in Mexico can be a most contentious business.

It is a lesson, in fact, that CONACYT has learned repeatedly over the past 2½ years. The very nature of its mission has brought it into conflict with the territorial imperatives of old-line agencies, but philosophical conflicts have also developed with some of its natural allies in the universities.

"This is a very conservative science community, kind of like the Faraday Society," an American observer in Mexico City comments. "CONACYT's penchant for press conferences just drives them up the wall. And they also object to these young whippersnappers coming along and telling them what they ought to be doing in the national interest."

From the provincial schools CONACYT may seem as a breath of fresh air, but in the major universities there is some disappointment that it has not developed into a funding agency along the lines of the National Science Foundation. The agency's heavy emphasis on applied research is viewed as a short-sighted play for the quick technological payoff, and the new institutes, small as they are, are regarded with some justification as potential competitors for talent and money.

Criticism has also focused on CONACYT's administration. The remarks of one prominent social scientist, in a recent interview, reflect the general tone:

> They have a tremendously large staff for the size of the budget, and there has been a lot of motion and not much accomplished. There is still an ad hoc quality to policy, a continuing search for a style and a role.
>
> There is a new awareness in government of the importance of research—that we can't just sit back and accept foreign technology—but there is still no coherent plan, no connection with economic planning such as it exists in Mexico.

Some of these difficulties can probably be traced to an overburdened top leadership. The agency's director until last month, Eugenio Méndez Docurro, doubled as Secretary of Communications and Transport and the council's main policy directorate has been composed of equally busy men. In May, however, the President relieved Mendez of his job at CONACYT and replaced him with a full-time director, Gerardo Bueno, an economist and presidential adviser on issues of importation of technology.

Agency officials, for their part, tend to agree that some of the criticism has been "solid." But a series of virulent attacks in the press in recent months—alleging, among other things, that CONACYT was frittering its money away on worthless projects and consorting with foreign multinational corporations—are regarded as unfair even by some of the agency's university critics. To some of the younger staff, the harshest blow came in February from Echeverría, who publicly rebuked the agency for "preparing and training employees for the multinational companies . . . of imperial objectives" through its scholarship programs, and for failing to adopt a properly patriotic attitude. A survey has since shown that only about 5 percent of the scholarship holders have ended up in multinational firms, and then did so mainly because no other jobs were available.

Morale in the agency appears to run a scale from gloom to qualified optimism. Some wonder privately whether Mexico is ready for science policy, and some of the agency's outside advisers even suggest that it may be doing the image of science more harm than good. In a country where research has only recently come to be regarded as socially useful employment, image is important.

But the consensus, if an outsider can really gauge consensus, seems brighter than that. Will CONACYT survive and succeed? One young and highly placed attorney in the agency paused a moment, sighed audibly, and replied that, yes, he thought that it would gradually bring new order to Mexican research. "We are just at the take-off point now," he said. "And this is the most difficult time."

—ROBERT GILLETTE

# RECENT DEATHS

**William F. Bradley**, 64; professor of engineering, University of Texas, Austin; 16 January.

**Lloyd A. Ferguson**, 40; associate professor of medicine, University of Chicago; 1 January.

**Thomas A. Foster**, 76; former pharmacist, director, U.S. Public Health Service; 4 January.

**Jacob H. Friedman**, 59; assistant clinical professor of psychiatry, Albert Einstein College of Medicine; 27 January.

**Walter C. Hamilton**, 41; deputy chairman, chemistry department, Brookhaven National Laboratory; 23 January.

**Edward Henderson**, 76; executive director, American Geriatrics Society; 5 January.

**Benjamin F. Holland**, 75; professor emeritus of education, University of Texas; 14 January.

**Jean L. Laffoon**, 50; professor of entomology, Iowa State University; 19 January.

**Nathan Lazar**, 74; professor emeritus of education, Ohio State University; 17 January.

**John D. Marshall, Jr.**, 49; associate clinical professor of psychiatry, Yale University; 10 January.

**Donald M. Maynard**, 44; professor of biology, University of Oregon; 28 January.

**Earl P. McBee**, 66; professor of industrial chemistry, Purdue University; 3 January.

**Harald H. Nielsen**, 69; professor emeritus of physics, Ohio State University; 8 January.

**William R. Ransom**, 97; retired professor of mathematics, Tufts University; 9 January.