be bad form and could be bad politics. But a tone, a wince, a bit of body language confirms second-hand reports that the feeling is there. It is not surprising that it is, since the discussion on accountability in Michigan amounts to an encounter between two groups of people with very different responsibilities and weltanschauungs. Physicians are not in the habit of telling their patients everything, and, in most places, medical school officials are not accustomed to telling their patrons in the legislature everything.

In Michigan, however, the legislators are pressing for a change. At a meeting last week called by Lane and state senate appropriations committee chairman Charles Zollar, there was reportedly a stormy scene. Lane said the legislature had been making important decisions on the basis of poor information, and he understood that there had been a lack of cooperation from the schools in providing better information. He then indicated that the committee didn't want to harass the schools, but that, if necessary, the committee would hold hearings at each school and even go into matters of salary and productivity to get the information. The meeting ended on a friendlier note, however, since the four schools responded with a pledge of cooperation.

In Michigan, relations between legislators and medical educators are evolving rapidly. It is evident that the days are done when legislators limited themselves to voting money for a building and then perhaps turning up for the ribbon-cutting ceremony. The legislators are in the process of extending action in the public interest in a way that may impinge on the traditional conception of academic freedom. There is a clear example of this in Michigan in the collision over university autonomy. Under the state constitution, universities have exercised considerable control over expenditure of funds. After the legislature recently "line-itemed" programs on which funds were to be spent, and thus restricted university self-determination, the universities went to court and had their autonomy confirmed. But the realities, as MSU president Clifford Wharton and other university officials acknowledge, are summed up in what one legislator observed, apparently without rancor: "They have the autonomy and we have the money and they have to come back up here next year."

The appropriations committees have pioneered in developing new mechanisms intended to ensure that public funds are spent effectively. This by no means ensures that the legislators or their advisers are infallible or that they are immune to old-style patronage or pork-barrel impulses. Medical school deans still get phone calls from legislators lobbying to get a constituent's son or daughter accepted as a student. But individual legislators have done a good deal to change the system. With Garland Lane, for example, as one observer said, "the constituent interest and the public interest have merged in his mind." The longer term effects, however, probably do not depend on personalities. In Michigan, and in many other states, the idea of linking numerate skills and the public interest is resulting in a new kind of accountability being built into the system.

The effects on higher education are already visible in states where legislatures have taken steps to prescribe contact hours for faculty or to force abandonment of doctoral or master's degree programs that are deemed uneconomic. In the medical education community, the awkward questions of the costs of medical education precipitated a search for a methodology in a sequence of studies funded by NIH but still not released in full. An even more ambitious effort is only now getting under way at the National Academy of Sciences' Institute of Medicine (*Science*, 2 June.) What seems to be happening in Michigan, therefore, is that educators and legislators are working out, however painfully, a new modus vivendi that is likely to become increasingly familiar elsewhere.

—JOHN WALSH

Earthquake Research: A Consequence of the Pluralistic System

Fragmented responsibility in national research on earthquakes and duplicative rivalry between two of the federal agencies concerned are among the findings of a report released last month by the General Accounting Office (GAO), the investigatory arm of Congress. A general response of those criticized is that the problems are smaller in reality than as portrayed in the GAO report, and that corrective action has now been taken.

The two agencies said by the GAO auditors to conduct overlapping research are the National Oceanic and Atmospheric Administration (NOAA) in the Department of Commerce and the Geological Survey in the Department of The Interior. Other agencies with fingers in the earthquake research pie are the National Science Foundation, the Atomic Energy Commission, and the Department of Defense. The GAO report, which is confined chiefly to civilian research, concludes that "the fragmentation of federal responsibility and the lack of national goals have made it extremely difficult for the various federal agencies supporting earthquake research to launch a coordinated attack on the nation's earthquake problem and to obtain maximum benefit from available resources."

As its prime example of uncoordinated research, the GAO report cites the studies of the San Andreas fault system in California conducted by NOAA and the Survey. NOAA's Earthquake Mechanism Laboratory (EML) is situated in San Francisco, and the Survey's National Center for Earthquake Research (NCER) is 35 miles south, in Menlo Park. The EML was established in 1964, NCER in the following year, the purpose of both being the study of earthquakes in general and the San Andreas fault in particular. Competition is a feature of all but the dullest branches of inquiry, but at what point in the overlapping of research interests does heuristic rivalry become unnecessary duplication? The GAO auditors view the competition be-

tween EML and NCER as a duplication of effort accompanied by failure to exchange data or coordinate plans. On the other hand, the directors of the two laboratories say that they are following parallel paths rather than overlapping paths and that their work has benefited from the stimulus of competition.

According to the GAO report, NOAA and the Survey conduct overlapping studies of microearthquakes, strain accumulation in the earth's crust, and fault movement, along the same portions of the major California earthquake faults. The two agencies use similar research equipment, but there is no regular exchange of data nor coordination in the planning of studies or placement of equipment. For example, NOAA has a network of 13 seismograph stations in California, and the Survey has an 83-station network. The director of EML, the GAO report says, "informed us that NOAA had not established as many seismograph stations as had Survey because EML was not interested in precise mapping of earthquake activity along the fault. . . . The director stated that NOAA and Survey did not coordinate the planning of their research projects or the placement of their stations."

Both NOAA and the Survey conduct geodetic programs, and both have networks of creepmeters straddling the major California faults. Both agencies developed their own creepmeters in-house. Officials of EML and NCER, say the GAO auditors, "informed us that the two creepmeter programs duplicated each other and that there had been no regular exchange by NOAA and Survey of data pertaining to creepmeter studies." Each agency has its own network of alignment arrays, used to measure slip along a fault, and tiltmeter stations. NOAA's six tiltmeters (only three of which are based in California) were developed and installed by a contractor for a total cost of $9,600; the Survey's 12 tiltmeters were developed in-house and installed for a total cost of $24,000.

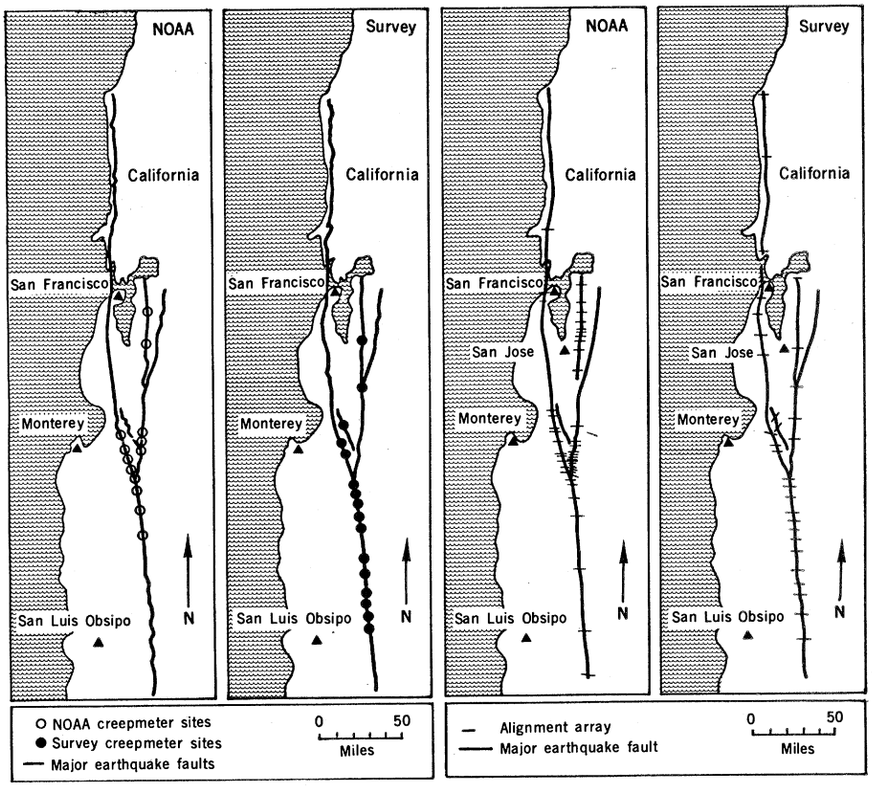
The GAO auditors say that, according to the director of EML, the Survey was allowed free access to EML's research records but that it had been a "one-way street" because of the Survey's reluctance to release data before its findings were published. An NCER official "informed us that the exchange of Survey's research data with NOAA would be beneficial to both agencies but that the data was not exchanged because of the distance [35 miles] and poor lines of communication between the two agencies."

"We believe that this reluctance to release research raw data was due to the professional importance that was attributed to published findings and the fact that Survey was trying to establish a position of leadership in the field of earthquake research," the GAO report states.

It is the custom of GAO reports to include comments from the agencies concerned. The joint response from NOAA and the Survey is that a parallel attack does not necessarily constitute wasteful duplication of effort: "Problems of earthquakes . . . [are] of sufficient national urgency that all reasonable approaches must be investigated concurrently." To which the GAO replies: "We have recognized that parallel research is sometimes necessary . . . but are of the view that such research must be planned and coordinated to derive maximum benefit from the applied resources."

Neither Don Tocher, director of EML, nor Jerry P. Eaton, head of the Office of Earth Resources and Crustal Studies in the NCER, has seen the final version of the GAO report, and neither is able to comment in detail. Eaton stresses that the GAO investigation was carried out 2 years ago, that any overlap is only apparent, and that in any case there are now formal coordinating arrangements between the two agencies. Both directors strongly believe that the GAO investigators, as accountants, failed to understand the scientific realities of the situation. Eaton remarks that it was "difficult to get the point across to the GAO people that having several approaches to the same problem by a different method is one of the efficient ways of getting at a solution in science. Nothing is more stimulating to a researcher than knowing that someone else is working on the same problem," he adds. According to Tocher, "The fact that you are using the same tools doesn't necessarily mean you are answering the same questions. I felt that the draft of the GAO report didn't understand that competition is a healthy part of scientific activity."

Eaton believes that, although there is competition at a management level between the Survey and NOAA, the overlap between his laboratory and EML is more apparent than real. True,



Location of creepmaster sites and alignment arrays operated along the San Andreas fault system by the Earthquake Mechanism Laboratory of the National Oceanic and Atmospheric Administration (NOAA) and by the National Center for Earthquake Research of the U.S. Geological Survey. [Redrawn by Marshall Kathan from GAO report]

the two labs are studying portions of the same section of fault, "but we are testing different equipment and different hypotheses. Our two different approaches should be pursued, even if both labs belonged to the same agency." Another area of apparent overlap is in the development of instruments such as tiltmeters. "But until recently no available tiltmeters were adequate—this is a frontier area of instrumentation research, where diverse approaches are desirable," Eaton says. Both he and Tocher believe that the combined total of instruments owned by each lab is inadequate to the needs of earthquake research in the area.

As for the failure to exchange data, alleged by the GAO, both directors assert that there is good communication between their laboratories. "Whenever

Chinese Doctors to Visit the United States

A group of physicians from the People's Republic of China will arrive in Washington, D.C., next week to begin a 3-week tour of the United States that will take them to five, and possibly six, cities. They will be the first physicians from their country to visit the United States since the early 1950's.

There is speculation that a group of nonmedical scientists may also visit the United States in the near future.

The Chinese physicians will be the guests of the Institute of Medicine (part of the National Academy of Sciences), the American Medical Association (AMA), and four American physicians and their wives who went to China in September 1971. Announcing the members of the Chinese delegation,* institute president John R. Hogness emphasized the "personal" nature of the visit and said that the federal government will not participate. Support for the visit by the Chinese, which will cost an estimated $80,000, will come from private sources, including the Rockefeller Foundation, the Charles F. Kettering Foundation, and the Commonwealth Fund.

Ever since tensions between the United States and the People's Republic of China were relaxed last year, American scientists and scientific institutions by the score have been vying for invitations to China and have been hopefully extending invitations to Chinese investigators to come here. The Chinese, apparently, had strong feelings against accepting any invitation from groups officially associated with the government. Thus, attempts by the academy to initiate contact between scientists have failed. Now, however, it appears that this situation is changing. With regard to the institute's participation, Hogness says, "The Chinese know that we are a branch of the academy. They also know that we are semi-autonomous."

Plans to have the Chinese physicians come to the United States have been in the works for months, and even now, with their arrival scheduled for 12 October, many details of the trip are tentative. Hogness thinks that they will arrive at Dulles by commercial airline from Paris. That is not certain. They will travel to New York, Boston, Kansas City, and San Francisco. They may or may not stop in Chicago, where the AMA has its headquarters.

Not long after they arrive in Washington, for example, the Chinese will be guests of honor at a banquet that Hogness and his wife will host in the great hall of the academy. At the conclusion of the visit, the AMA will give a farewell banquet, probably at San Francisco's St. Francis Hotel. In between, the Chinese will—among other things—see a Chevrolet plant and visit a wheat field in Kansas where they may also take time out for some personal shopping.

In a more serious vein, plans are being made to show the Chinese physicians whatever aspects of U.S. medicine they wish to see. While in Washington, D.C., they will almost certainly go to the National Institutes of Health, where they will stop at the National Heart and Lung Institute and the National Cancer Institute. "They have expressed particular interest in cardiovascular surgery and cardiology in general, and in cancer," says Hogness. "They are also interested in what we're doing in public health and in population control."

The institute may arrange special symposiums in cardiovascular surgery and cancer for the visitors. However, Hogness stresses, they are not coming here to lecture and will probably engage in nothing more than small seminars with other scientists. Nor, he says, are they coming as "an acupuncture team." The majority of the members of the Chinese delegation, as far as is known, are physicians trained in Western medicine. A couple of them are traditional Chinese physicians.

Most of the details of establishing ties between the Chinese and American groups have been handled by E. Grey Dimond, a Kansas City cardiologist who was one of the four American physicians to first visit China. Dimond is provost for health sciences at the University of Missouri. The other host physicians are Samuel Rosen, emeritus clinical professor of otolaryngology at Mount Sinai School of Medicine; Victor Sidel, chief of the department of social medicine at the Montefiore Hospital and Medical Center in the Bronx; and Paul Dudley White, emeritus professor of medicine at Harvard Medical School. It was Dimond who contacted the Chinese about the trip, made connections with the institute and the AMA, and generally paved the way for the visit.

In addition to stops at medical facilities, the institute is planning some sightseeing for the Chinese and is trying to leave them a bit of free time as well. Says Hogness, "We're trying to make their visit as pleasant and relaxed as possible."—B.J.C.

*Wu Wei-jan, vice-chairman of the association of surgery, All-China Medical Association, and deputy chief of surgery, Capital Hospital, Chinese Academy of Medical Sciences, will head the delegation. Deputy head of the delegation will be Fu Yi-cheng, deputy secretary-general of the All-China Medical Association. Members of the delegation are Lin Chiao-chih, professor of gynecology and obstetrics; Wu Hsueh-yu, director of ENT and Eye Hospital of the No. 1 Shanghai Medical College, professor; Li Yen-shan, attending of the hospital of the Wuhan Medical College, Hupeh Province, lecturer; Li Ping, surgeon of Jeh Tan Hospital under the Chinese Academy of Medical Sciences; Liu Shih-lien, assistant research fellow of the Chinese Academy of Medical Sciences; Han Jui, assistant research fellow of the Chinese Academy of Medical Sciences: Chou Kuan-han, associate director of surgery of No. 3 Hospital of the Peking Medical College; Chang Shu-shun, doctor of the Peking Tuberculosis Research Institute; Hsu Chia-yu, associate director of internal medicine of the Tung Fang Hung Hospital under the No. 2 Shanghai Medical College; Wang Lien-sheng, interpreter; and Wang Kuan-sheng, secretary.

there is a creep event, one of our guys is on the phone to the Geological Survey within 10 minutes," says Tocher. "It is standard practice for our people to go to EML and read their data, which is included in our reports, and vice versa," Eaton states. He adds: "Some people in the organization may feel competitive, and it is quite possible that individuals on our side or NOAA's have complained that they could not get data. But if they had put their request through me or through Tocher, they would have had no trouble." The principal area of sensitivity between the two agencies is that of funding, Eaton says. "But most of that goes on well over the heads of the people working here. Both agencies are desperate to get funds for work in the field. One of the real deterrents has been this low-level sniping."

Wasteful duplication or a parallel approach engendering fruitful competition—which is the more accurate description? Two University of California seismologists consulted by *Science* are inclined to see a measure of truth in both views. According to Bruce A. Bolt, director of the seismographic station at Berkeley, "There has been overlap in the sense of having redundant sensors and there was not very close liaison, but this has improved in the last year." There has also been redundancy between the two federal agencies and Berkeley. Traditionally, Caltech has been responsible for seismology in southern California, and Berkeley for central and northern California. "The federal agencies came in on top of this system and went their own way," Bolt says.

Another senior seismologist at the University of California, who declines to be named, believes that the argument of nonoverlap is weak. "You cannot have two instrument networks in the same area without having duplication of maintenance, storage, and so forth. But I think this is a hell of a tempest in a teapot because the amount of money involved is so little. To the extent that competition is good, this situation is meritorious, and I believe in the free enterprise system. But I don't think I would have located the two laboratories in the same area. San Francisco is a nice place to live, but southern California is more important scientifically." (Both EML and NCER grew out of installations already in existence on their respective sites. Eaton explains that the San Andreas fault system, being simpler than the situation in southern California, seemed more likely to produce answers about how earthquakes work.)

The same University of California scientist sees the overlap between NOAA and the Survey as the result of the recent convergence of seismology and geology, the respective disciplines in which each agency has traditionally been strongest. "The friction between the two agencies has led to a pox-on-both-your-houses reaction. I would like to put it the other way around. This would not have happened if the directors of NOAA and the Survey hadn't been aggressively pushing their two agencies along." As for the two laboratories, "the case for their being independent is weaker than the case for their merging, but I'm not sure what I mean by merging."

According to Bolt, expenditures, which he estimates at hundreds of thousands of dollars, could have been avoided if NOAA and the Survey had gotten together at an earlier stage. "But I am not against having two groups working in the same area," he says. "My general solution would be to rationalize the capital expenditures of the two laboratories but maintain their integrity as separate institutions."

Why was the possibility of overlap between EML and NCER not foreseen? According to Gilman F. Blake of the Office of Science and Technology (OST), the expenditures of the two laboratories have been small (NCER had a budget of $1.8 million, EML $350,000, in fiscal 1972) and below the level that would ordinarily reach the OST's attention. "The OST doesn't usually delve that deeply into program details—this was not a problem at policy level."

As for the GAO's complaint that there is no national earthquake research program, the OST believes this omission has now been remedied by the definition of program goals in the statement of the fiscal 1973 budget. Redefinition of the responsibilities of the various agencies involved in earthquake research may result from a study now being undertaken by the Office of Management and Budget (OMB). The study, which is to be completed before the preparation of the 1974 budget, will apparently not be made public. This is a pity, because the alleged duplication of research between the two earthquake laboratories, and the OMB's rationale for resolving it, raise important issues about the organization of research.—NICHOLAS WADE

APPOINTMENTS

Thomas F. Zimmerman, assistant to the director, medical education division, American Medical Association, to dean, School of Associated Medical Sciences, University of Illinois Medical Center Campus. . . . **Bruno A. Boley**, chairman, theoretical and applied mechanics department, Cornell University, to dean, Technological Institute, Northwestern University. . . . **Peter D. Lax**, professor of mathematics, New York University, to head, all-university mathematics department. . . . **Robert D. Dripps**, chairman, anesthesiology department, University of Pennsylvania School of Medicine, to vice president for health affairs at the university. . . . **James J. Ferguson, Jr.**, professor of biochemistry, University of Pennsylvania School of Medicine, to chairman, biochemistry department at the university. . . . **Francis Hunter**, acting chairman, biological sciences department, College of Pacific, University of the Pacific, appointed chairman. . . . **George A. Condouris**, acting chairman, pharmacology department, College of Medicine and Dentistry of New Jersey–New Jersey Medical School, appointed chairman. . . . **Alfred Stracher**, acting chairman, biochemistry department, Downstate Medical Center, State University of New York, Brooklyn, appointed chairman. . . . **Leon M. Lessinger**, professor of education, Georgia State University, to dean, College of Education, University of South Carolina. . . . **Howard K. Suzuki**, acting dean, College of Health Related Professions, University of Florida, Gainesville, appointed dean. . . . **Leo F. Van Hoey**, associate professor of sociology, Lehigh University, to chairman, sociology and anthropology department, Lake Forest College. . . . At the University of Texas: **W. Rea Keast**, former president, Wayne State University, to director, center for higher education; and **David C. Glass**, professor of psychology, New York University, to chairman, psychology department. . . . **Frank M. Shepard**, associate professor of pediatrics, University of Virginia, to chairman, pediatrics department, Creighton University. . . . **Pryse H. Duerfeldt**, head, psychology department, University of Portland, to head, psychology department, Northern Michigan University. . . . **Carl W. Borgmann**, former president, University of Vermont, to dean, Graduate School, University of Colorado.