and logic; no special advantage can be given one side or the other.

In some cases it may not be possible to reach a truly reasonable decision. I suggest a solution for these cases. The author is informed of the referee's view and is offered publication provided a statement from the referee is appended to the paper; this statement is identified as a referee's appendix, is signed by the referee, and is submitted to the author when the offer of publication is made. The same information is transmitted to the referee. If both agree, paper and appendix are published. If the referee demurs, the paper is published without the appendix. If the author demurs, nothing is published.

In view of the high degree of specialization that characterizes much current research, one cannot expect the editor of a journal to have knowledge of the background and methods pertinent to every paper submitted to, or published by, his journal. For this reason the referee system has great merit and usefulness if the editor makes the system work properly for him, and if the referees understand what they are supposed to do. One does expect the editor to have a sense of fairness and an ability to apply general principles of logic. One hopes he will be an active participant in the decision-making process. But, most of all, one wishes that editors and referees would realize that readers have a little sense too and do not have to be protected so assiduously.

Earthquake Prediction: OST Panel Recommends 10-Year Program

A panel of experts, formed in response to the political and scientific aftershocks of the Good Friday earthquake in Alaska in 1964, has recommended a 10-year program of research on earthquake prediction and earthquake engineering. The program would cost an estimated $137 million over the 10 years.

Soon after the big quake in Alaska, the director of the Office of Science and Technology, Donald F. Hornig, asked geophysicist Frank Press, now a departmental chairman at M.I.T. to assemble an "ad hoc committee on earthquake prediction." Last week saw the release of the committee's report, which said, in essence, that carrying out of the proposal (i) would offer a fair chance to develop a method of giving warnings "hours to days" in advance of major earthquakes, and (ii) would, through engineering research, provide means of minimizing loss of life and property damage, even if a warning system were not achieved.

At a meeting with reporters last week Press said that 10 years ago the possibility of predicting earthquakes was considered remote. A more sanguine view among scientists today has been encouraged primarily by rapid advances in instrumentation and techniques, and also by hints—still not in the category of evidence—that "premonitory events" may be detectable.

The International Geophysical Year yielded improved geophysical instrumentation. And the International Upper Mantle Project, which ends in 1967, and space-agency-sponsored work toward developing seismological instruments for study of the moon's surface have also contributed to advances. But the big impetus toward improved instrumentation has come from the Department of Defense's project to develop methods for detecting and identifying underground tests of nuclear weapons.

This project can be traced to the so-called conference of experts held in Geneva in the summer of 1958, an East-West meeting convened for the purpose of assessing technical capabilities for detecting nuclear explosions. The conclusions were that these capabilities were insufficient. Subsequently, in the United States, acceptance of recommendations by a panel headed by Lloyd V. Berkner led to the establishment of the three-part Project Vela. Vela Uniform deals with problems of underground and undersea detonation; Vela Hotel is concerned with ground-based detection; and Vela Sierra, with a satellite-based detection system for high-altitude explosions.

Vela was administered by the Department of Defense's Advanced Research Projects Agency, a contracting and management organization which deals with universities, industry, and other government agencies. Under the Vela Uniform program rapid advances were made in the development of instruments and techniques; perhaps the most notable of these was the placement of highly sensitive seismometers in holes some 10,000 feet deep. But perhaps the most important effect of Vela has been the adoption of a "systems approach." A flow of funds into a field that had been undermanned and underfinanced made it possible to employ "arrays" of improved instruments and to tie these into computerized systems.

A culmination of this new approach is to be found in the Large Aperture Seismic Array (the acronym LASA, rhymes with NASA), dedicated this week in Montana. LASA boasts some 525 instruments arranged in 21 clusters buried 200 feet in the ground and distributed over an area 150 miles square. Despite its dedication date, LASA was in working order in time to record the results of the subsurface detonation, last month, of 200 tons of chemical explosives in an old ship 70 miles off the Virginia coast. Other tests are scheduled, including an undersea blast in the Pacific and detonation of an atomic device deep underground in the Aleutians.

LASA is reportedly a vast improvement on earlier models effective in detecting earthquakes, but the question of whether it is possible to distinguish an earthquake from an underground nuclear explosion apparently is still an open one. And it seems still to be the official United States view that scientific means of making the distinction are still lacking, the Soviets to the contrary notwithstanding.

While the program recommended by the Press committee would profit from the momentum of the Vela program, its breadth and the difference in its

aims prevent it from being regarded as a continuation of Vela.

The proposed program has five main parts: (i) geological and geophysical field studies; (ii) instrumentation of seismic zones; (iii) research on the physical basis of earthquakes; (iv) research in earthquake engineering; and (v) a "miscellaneous projects" category which includes an item of $10 million for research in earthquake analysis and prediction.

A total of $74.4 million, or more than half the estimated total cost of $137 million, would go into the instrumentation of seismic zones. The object, according to Press, would be to measure "all aspects of the physical environment in the vicinity of earthquakes, looking for an empirical predictive pattern."

In the report, the rationale for instrumentation is as follows:

"This program is directed primarily at monitoring with the greatest achievable sensitivity all possible indicators foretelling the occurrence of earthquakes. It represents an empirical approach in the absence of a confirmed theory for the mechanism of earthquakes. On the other hand, all phenomena reported [by reputable scientists] to have preceded earthquakes will be checked. The pre-earthquake activity predicted by the main theories of the earthquake mechanism will be examined. The level of stress will be monitored in seismic zones against the eventuality that the stress history is pertinent to the occurrence of an earthquake. Strain and tilt fields will be observed in a continuous fashion in case creep acceleration prior to fracture is significant. Changes in the local magnetic, electric, and gravitational fields may be related to changes in the stress or the physical state of rock, both of which may precede a major shock. The statistics of strain release by extremely small shocks (energy release corresponding to a few pounds of TNT) may also indicate changes in physical state. Experiments in mines and laboratories which also suggest changes in the occurrence of microearthquakes prior to fracture will be expanded to explore their pertinence to actual earthquakes. The program is designed to maximize the possibility that the zones being monitored are also the zones within which earthquakes will occur. The resulting data will be of fundamental importance to the earth sciences, bearing as they do on deformation, mountain building, continental drift, and other dynamic processes within the earth."

Fault zones in California and Alaska would be instrumented, and where practicable the instruments would be linked to computers. The hope will be to "trap" an earthquake big enough so that the data collected will throw light on the question of the possibility of prediction.

The committee urges close cooperation with Japanese scientists who have launched their own 10-year program of intensive empirical studies in a country which provides a rich ground for earthquake research. In Japan, instruments have recorded changes in the advance of quakes which some scientists have suggested may be "premonitory events." But Press says that, although strains or tilts may have occurred before some earthquakes, this is not evidence that earthquakes always follow such occurrences.

In the proposed program about $12 million would be earmarked for geological and geophysical field studies in quake-prone areas. Research on the physical basis of earthquakes, with attention to such fields as rock mechanics, would get some $15 million over 10 years. The miscellaneous-projects category is allotted $16 million, with $1 million a year going to support research in analysis and prediction of earthquakes.

Research in earthquake engineering is ticketed for an allotment of $19.6 million over the 10 years. The effort would be carried on in five categories: strong-motion seismology, soil mechanics and foundation engineering, structural dynamics, design techniques, and economic studies.

Implementation of the engineering portion of the program is strongly urged by the committee, although this effort falls somewhat outside the province of a group commissioned to make recommendations on earthquake prediction. Chief products of this program would be "seismic zoning," for areas vulnerable to earthquakes and tidal waves, and design standards which could be incorporated into building codes. Press's comment was, "whether or not earthquakes are predictable, the major contribution of science and technology to the earthquake problem may well come from the engineering program."

Prospects for acceptance of the program in its pristine form are difficult to predict. No matter how high the prestige of the panel members, the proposal does not yet have specific backing in Congress or in the operating agencies. The report, therefore, can be likened to the proverbial arrow shot into the air.

Only when the reactions of the agencies concerned are in—the Army Engineers, the Geological Survey, the Coast and Geodetic Survey (which operates the tidal wave warning system), the new Environmental Science Services Administration, and the National Science Foundation—and the process of bargaining proceeds will the prospects become clearer.

In this case, the cooperation of the states most directly affected, California and Alaska, will be required. And the attitude of Congress and of administration budget makers will ultimately be decisive. Not only is the level of funding for earthquake research sure to be debated, but division of funds between prediction research and engineering is also likely to be scrutinized.

Federal investment in Project Vela Uniform is declining, and the tentative price tag of $137 million on the 10-year earthquake research program would roughly equal the amount spent

NSF To Coordinate Solar Study

The Federal Council on Science and Technology has designated the National Science Foundation as the federal coordinating agency for U.S. observations of the total solar eclipse in South America, 12 November 1966. American scientists, whether or not they are members of a federal agency, are invited to notify the coordinator, Robert Fleischer, of their plans, preferably by 1 January. It is hoped that scientists' requests for assistance from South American governments and institutions will be made through Fleischer, to insure their consistency with each other and with the plans of South American scientists. Additional information is available from Fleischer, Program Director, Solar Terrestrial Research Program, NSF, 1800 G St., NW, Washington, D.C. 20550.

on underground detection research under Vela.

While the report refers ruefully to a shortage of trained manpower in the field and a scarcity of laboratories devoted to pertinent activity, it is expected that transfers from Vela projects would take up some slack.

The report is a bid for a long-term "mission-oriented" program. Earthquakes certainly are unpopular. But a kind of double standard applies to government support of research. Defense and health research are treated more open-handedly than other kinds, and it remains to be seen whether earthquake research ranks in the favored category.—JOHN WALSH

New Health Act: AMA Criticism Reflected in Adoption of Bill on Heart, Cancer, and Stroke

Of few federal programs could it be asked as aptly as of the Heart Disease, Cancer, and Stroke program, "What's in a name?" The bill signed by President Johnson last week has about as little relation to the report of the Presidential commission of the same name as Oxford, Mississippi, has to Oxford, England. The new program is not a plan for a massive categorical attack on heart disease, cancer, and stroke. It is a comparatively modest and experimental program designed to encourage local medical facilities to cooperate with each other.

Throughout its legislative history enthusiasts viewed the Heart Disease, Cancer, and Stroke bill in much the way some parents view naming a child after a difficult relative—a necessary way to obtain certain dividends. This strategy backfired when the DeBakey report elicited more antagonism than support from the medical profession. And the situation was not improved when the administration introduced its bill based on the DeBakey proposals (*Science*, 14 May, 20 August). The emphasis on categorical research and treatment centers found in the report gave way in the bill to emphasis on regional medical complexes centered around medical schools. But opponents found the legislation vague, ill-conceived, and revolutionary, and even supporters advocated changes that cast doubt on their faith in the central idea.

Pressures from the administration, in combination with the American Medical Association's preoccupation with Medicare earlier in the congressional session, enabled the bill to go speedily through the Senate. By the time it got to the House, however, the AMA was on its toes, and began an intensive campaign for postponing the program until next year. When that proved impossible, the AMA capitulated and, instead of following the tack it took on Medicare—refusing to negotiate until the bill became law—sent delegates to Washington for high-level conferences with the President, with Secretary of Health, Education, and Welfare John Gardner, and with members of the House Interstate and Foreign Commerce Committee, which was considering the bill. The AMA's suggestions were not all unique: many found echoes in suggestions from other groups such as the American Heart Association, from members of the Commerce Committee who heard 8 days of testimony, and even from representatives of the administration who, having drafted the bill hurriedly to begin with, were glad for the opportunity to have some of their second thoughts fitted in. But the chief result of the AMA's intervention is the oddity that the people who played the biggest role in redefining and shaping the program were the people who began as its bitterest foes.

Changes Made

The result of the AMA-favored changes has been to transform what was, in effect, a crash program with enormous flexibility into a pilot project with more tightly defined objectives. This is actually quite explicit. The Senate-passed bill (itself a reduction from the billion-dollar proposals of the DeBakey report) called for expenditures of $650 million over a 4-year period. The money was to finance about 30 regional centers. The new version authorizes $340 million to be spent over 3 years on planning, feasibility studies, and pilot projects. It is now expected that about eight such programs will get under way soon.

Within the reduced scope of the program, many specific changes have been made. Not all are purely semantic, as congressional sponsors of the legislation encouraged their colleagues to believe. The phrase "regional medical complex" has been replaced by the phrase "regional medical program"—in part to alleviate fears that what was intended was a massive federal network that would compete with, and perhaps downgrade, local medical facilities. To emphasize further that the subject of the bill was systems, not facilities, funds for construction were eliminated. Only small-scale repairs and alterations will be funded. Throughout the legislation the word *cooperation* was substituted for the word *coordination*, which, again, critics felt implied the threat of federal control over medical practice.

An additional reason for the shift to *cooperation* was widespread suspicion that *coordination* was a euphemism for the idea that the medical schools should run the show. As drafted by the administration, the bill provided that each regional complex had to include a medical school. This fitted in well with the views of HEW health planners, who believe that medical schools should acquire a community-service orientation that is now the exception rather than the rule. But this notion had certain drawbacks. First, it meant that if a medical school in a given area chose not to participate in the program, no other local health units would be able to do so. And second, it automatically excluded from participation broad areas of the country where no medical school exists. It seems to have been the second consideration, rather more than the first, which influenced both House and Senate to drop the requirement for medical school participation. As now defined, a "regional medical program" will consist simply of "one or more medical centers, one or more clinical research centers and one or more hospitals," a medical center being defined as a medical school or other institution involved in postgraduate medical training. Gone with the wind are the categorical research centers and diagnostic and treatment stations that DeBakey once called the "major innovative thrust" of the Commission report.

The remaining AMA changes have more to do with protecting the status of physicians than with the substance of the program. Members of the national advisory council for the regional programs were originally to include one expert each in the fields of heart disease, cancer, and stroke; now they must include practicing physicians as well. Local advisory committees, whose makeup was left vague in the administration version, are similarly to include practicing doctors as well as representatives of local medical societies. In addition, the function of these two units has been upgraded: any grant must now