forthcoming. OE's research budget calls for nearly $20 million in project-support money, but even if this figure is cut, through a combination of congressional and Administration action, the new basic research program, because of the relatively high priority it has been given, is likely to survive intact.

The work of the committee will hardly be painless, for it must come to grips with a number of knotty questions. If Suppes is right about the response, $1 million will be all too little, and the problem will be to decide how much money to allot the typical grant. High amounts will mean fewer grants; low amounts, diminished chances of significant results. One source predicts that the typical grant will run between $50,000 and $75,000, and that one or two will be a good bit more. A second question concerns the large number of disciplines involved. Where will most of the money go? Suppes hopes for a wide spread, and his guess is that, if there is an emphasis, it will be on the behavioral sciences. Finally, how close a relevance to education will the committee demand in the project ideas it will judge? Suppes says, "This is something we can't quantify or spell out precisely. All we can say is that the relevance must be real, not token. We will want the results of a project to contribute to fundamental knowledge, and we will want them to have major implications for education."

NAS's David believes the program could produce real changes in OE's approach to research activities. "It may help OE settle on a strategy of fundamental research of long-range character, not so much on projects aimed at quick solutions." About the level of funding, OE and NAS earlier this year were talking in terms of a growth in expenditures on basic research in education to somewhere between $20 million and $30 million a year by 1973. Remembering this year's money squeeze and knowing full well what competition for federal funds lies ahead even if the war ends, the scientific and educational communities might be excused for harboring doubt about that. Even so, David believes this year's level of funding "can generate a fair amount of activity," and, given the high priority OE has assigned the program, he thinks the support will grow. What is more, he adds, the program promises to enlist the interest of many researchers outside the field of education and to generate ideas which can be proposed not only to OE but to agencies such as the National Institute of Mental Health.

David's division, which was given a $73,000 grant earlier this year by OE, will be administratively responsible for the committee. Sherman Ross has come from a position with the American Psychological Association to serve as chief staff officer. The committee will meet several times a year and will create small, regional, multidisciplinary groups to deal with routine screening and other work.

Legally, of course, OE is responsible for making the grants and theoretically it could reject the committee's selections and make its own. But all concerned agree that, in practice, the committee will have the last word on awards. OE could have assembled its own in-house advisory panel; instead it turned to NAS. Operation of a grant-selection panel within NAS–NRC is unusual although not unique. And the Committee on Basic Research in Education, it should be noted, is not simply a group of experts sifting grant applications; it is expected to provide broad-range advice to OE on research policy and programs and to serve as a link with researchers who might otherwise ignore OE. The new arrangement indicates that the academy and some policy makers, at least in the Office of Education, feel that it's time some tired precedents in educational research were broken.—JAMES WELSH

James Welsh is a Washington newspaperman with a special interest in education.

New Canal: What about Bioenvironmental Research?

The protests of scientists concerned about U.S. plans to build a new interoceanic Atlantic-Pacific sea-level canal seem, like television commercials, to grow louder and longer. These scientists claim that, unless thorough, extensive scientific studies are carried out before the oceans are linked, serious and irremediable ecological consequences may occur.

Since 1906 it has been recognized that eventually another canal would have to be built, as traffic through the Panama Canal increases. Some 1400 ships now plying the seas cannot pass through the existing canal because of draft and beam limitations. It is estimated that the canal will have reached capacity around 1985, with a flow of 19,000 ships a year. About 13,000 ships now pass through the canal each year.

After the outbreak of civil violence in Panama in 1964, President Johnson asked Congress to establish a five-member Canal Study Commission to lay the groundwork for a new canal project. Members of the commission are Robert Anderson (chairman), a diplomat; Robert Storey, a lawyer; Milton S. Eisenhower, a university president; Kenneth Fields, a former Army engineer; and Raymond Hill, a civilian engineer. The commission has an appropriation of $24 million and has been assigned a final reporting date of 1 December 1970. The commission's task is, among other things, to recommend a location for a second canal, to study the scope of the anticipated negotiations with the country involved, to recommend an excavation technique, to assess costs and means of support, and to consider a defense system for the canal. Some critics say that, with a multitude of political, diplomatic, engineering, military, and financial problems facing the commission, the scientific considerations tend to get lost.

Scientists find two proposals for the canal particularly controversial: a proposal that the channel should be at sea level, thus intermixing the two oceans, and a proposal that atomic energy be used to dig it. They argue that consideration of either of these proposals should be preceded by extensive research into the possible environmental

consequences. Scientists fear, for example, that linking the two oceans might result in serious changes in certain species of marine life, which may be genetically different in the Atlantic and the Pacific. They say that interbreeding may lead to sterilization of the offspring in some species. They wonder whether existing predator-prey relationships would be upset, with certain species becoming extinct and others overabundant. They worry lest temperature and water currents might be changed, and the balance of marine life thereby affected. They are also concerned about the sociological effects of the canal upon nearby tribal populations, which might be uprooted from their homes and means of livelihood. They warn that the use of atomic explosives to dig the canal may endanger plant and marine species, contaminate the food chain, and ultimately harm man.

Some scientists note that the only large-scale Canal Commission research program now under way is a Corps of Engineers study of feasible engineering methods. Environmental research pertaining to the canal is only modestly supported and is limited in scope. The Atomic Energy Commission (AEC) and the Smithsonian Institution are conducting research programs specifically designed to yield data on the canal. The commission also has asked the National Science Foundation and the Interior Department's Bureau of Fisheries to orient their own research programs, where possible, with canal studies.

The Smithsonian ecological research is self-supported. Initiated in 1967, it was funded at $55,000 last year and at $73,000 this year. The program focuses primarily on the possible biological consequences of linking the oceans with a saltwater channel, which would make possible the free movement of all types of tropical ocean biota across the isthmus. The Smithsonian's Tropical Research Institute, near Balboa, in the Canal Zone, conducts studies of existing marine life and the ocean environment. Projects vary from a comparative study of the effects of temperature changes on the metabolism of tropical fish to an investigation of behavioral discrimination in Atlantic and Pacific shallow-water sea urchins. Only early results of this research are available—results such as the discovery that certain marine species can be crossbred.

The AEC's research program is supported by the Canal Commission. Begun in 1965, the 5-year, $3-million research project has a more narrow focus than the Smithsonian research. The AEC is responsible for making radiological studies of the safety of nuclear excavation. These AEC bioenvironmental studies are contracted to Battelle Memorial Institute, which, in turn, subcontracts to universities, firms, and individuals. Projects include a study of human, agricultural, freshwater, and saltwater ecology, the construction of predictive models on fallout distribution patterns, and analyses of the transfer of radioactivity through the food chain. The Battelle Institute's programs are still largely in the data-collecting stages. One project which is well advanced, however, is an experimental program with radioactive nuclides. The institute has found nearly 300 nuclides unsafe for biological species.

Canal Commission executive director John Sheffey recently told *Science* that Commission members are in the process of negotiating ecological research proposals with Battelle Memorial Institute, which total $250,000. Sheffey said he has had "very strong assurance" from Commission members who plan to meet next Monday that some of Battelle's projects will be approved. Battelle has primarily proposed completing identification of marine life specimens collected by Gilbert L. Voss, professor of marine sciences at the University of Miami, to learn more about marine life populations.

Additional Research Proposed

Some scientists who argue that AEC and Smithsonian ecological research programs are inadequate want the federal government to sponsor a much more comprehensive, in-depth environmental study relating to the canal, which would run the cost into the millions figure, instead of thousands. Sidney Galler, Smithsonian assistant secretary for science, feels that such research would cost between $25 and $50 million over a period of 15 to 25 years and would involve numerous government and private institutions. (It is estimated that the chartering, operation, and data collection for one research ship for 1 year would cost about $2.5 million. At least two ships, one on the Atlantic and one on the Pacific side, would be needed to conduct studies over a period of years.) Ecologists recommend that a survey and extensive studies be conducted of both the deep ocean and the continental shelf. The focus, they say, should be on food-chain studies, marine life, ocean currents, fish breeding, temperature differentials, wind conditions, and transplantation possibilities. The first phase of such a research program would be the gathering of fundamental data on biological, physical, and anthropoligical resources in the Pacific and Caribbean. This would be followed by comprehensive testing, by predictions, and possibly by a preventive program, based on systems analysis, mathematical modelings, and pilot testings. This research would be conducted during as well as before construction of the canal, and interim results would be made available for technical applications.

"With the exception of Battelle's work, there has not been a comprehensive research program with the object of ecological evaluation either proposed or supported by the Commission," Smithsonian's Galler has said. His views are largely shared by Smithsonian scientists Ira Rubinoff, assistant director of marine biology, Smithsonian Tropical Research Institute; I. E. Wallen, director of the Office of Oceanography and Limnology; and David Challinor, deputy director of international activity. The Smithsonian scientists would like to see the federal government establish a national commission of environmental assessment, which would sponsor full scientific research on the possible ecological consequences of construction of the canal and propose prophylactic action where necessary.

In an article in *Science* (30 August) Ira Rubinoff suggested the creation of a multidisciplinary environmental control commission with broad powers to assess potential alterations in the environment. He has also suggested that a scientific advisory panel consisting of oceanographers, ecologists, and marine scientists be convened to discuss the scope of feasible pre-construction experimental research. Challinor recommends training scientists to assess the research needs. He says there is only a handful of scientists in the nation who have the expertise and the reputation to handle the canal-research data.

But the fanciful red brick towers of the Smithsonian are not the only place where comments flow. Richard Rosenblatt, an associate professor of marine biology at Scripps Oceanographic Institute, also feels that present knowledge and research are inadequate. One of his deepest concerns is a fear that the canal will place different morphological species in direct competition with each other, thereby disrupting the

marine balance. Perhaps the most outspoken critic of the Canal Commission's proposal to build a sea-level channel is Lamont Cole, an ecologist at Cornell University. He objects to linking the oceans without long-term breeding experiments on what he believes may be genetically different marine populations; he warns that marine life is highly sensitive to even the most minute temperature differentials. On the question of atomic energy, Cole feels that present expertise is not sufficient to prevent dangerous radioactive isotopes from contaminating water and land and eventually upsetting the food chain. "I think this is the most irresponsible suggestion that I can remember since Admiral Byrd's senile proposal to blow ice caps off Antarctica," he says.

Ecologists will face numerous problems in their efforts to secure an intensive canal bioenvironmental research program. For one thing, an economy-minded Congress indicated last spring that it was not entirely sympathetic with the Canal Commission's financial problems. An extension of the commission's reporting date by a year and a half and an increase of $6.5 million were granted only after considerable debate.

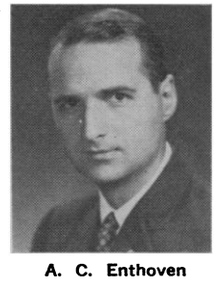
Another problem is that of possible conflicts of interest. The AEC, for example, is charged with promoting the peaceful uses of atomic energy, yet it is also responsible for insuring that safe radioactivity levels are maintained. Thus far there has been little interest shown by any agencies other than AEC and the Smithsonian in canal bioenvironmental research.

Not all of the problems relating to the canal are ecological. Another issue of interest to scientists is the question of the nuclear test ban treaty. If the U.S. Government decides to use atomic energy to build the canal, the present international nuclear test ban treaty, which prohibits nuclear explosions which would cause radioactivity to be present beyond a nation's territorial limits, would have to be changed. Some U.S. officials believe the U.S. could obtain Soviet consent if, in exchange, the U.S. would agree to allow the Russians to use atomic energy to build harbors in the Baltic. But this, of course, is speculation.

There are also vested political considerations involving the Canal Commission, evidenced by a comment from Canal Commission executive director Sheffey: "They [scientists] are interested in research, whereas we are interested in tactical problems." While political, engineering, and legal interests are represented on the five-member Canal Commission, there is no spokesman for scientific interests per se. Sheffey admits that some government officials take the view that "research is nice to have, but not very important," and he adds, "we can't be certain of the biological implications, until after the canal is built anyway—regardless of how much research is done now." Sheffey does not view the potential environmental consequences of a canal as particularly serious. "The possibilities of any serious disruptions to nature are very remote," he says, "and the potential threat to biota is so insignificant that it doesn't merit spending a lot of money on it." Sheffey also added, "it is obvious that Wallen and other Smithsonian scientists adopt the policy of taking an alarmist view to attract attention, and they tacitly admit it."

On the other hand, scientists feel that planning for the canal provides an opportunity to collect and analyze invaluable ecological data through extensive research. "I think its sole justification should be science. . . . This is a tremendously interesting once-in-5-million-years experiment," Wallen says. A lot of ecologists also seem to feel that the planning stages for the new canal provide a classic opportunity for scientists to do what they can to see that man does not manipulate his environment on a major scale without assessing the consequences.—MARTI MUELLER

APPOINTMENTS



A. C. Enthoven

R. W. Peterson

Alain C. Enthoven, assistant secretary of the Defense Department for Systems Analysis, to vice president for economic planning of Lytton Industries. . . . **Russell W. Peterson**, director of the research and development section of the development department of E. I. du Pont de Nemours & Co., to governor of Delaware. . . . **Adolf R. Hochstim**, a staff scientist at the Institute for Defense Analyses, to director of the newly formed Research Institute for Engineering Sciences at Wayne State University. . . . **Charles E. Lindley**, head of the department of animal husbandry at Mississippi State University, to dean of the college of agriculture there. . . . **Bayard R. Hand**, director of product and market planning for Fairchild Camera and Instrument Corporation, to vice president of finance for Research Corporation, which is a foundation for the advancement of science. . . . **Panayotis G. Katsoyannis**, head of the division of biochemistry at the Medical Research Center of Brookhaven National Laboratory, to chairman of the department of biochemistry at Mt. Sinai School of Medicine of the City University of New York. . . . **LeRoy W. Nittler**, acting director of the seed investigations department at Cornell University's New York State Agricultural Experiment Station, to head of the department; also at the station, **Robert M. Gilmer**, acting head of the department of plant pathology, to head of the department. . . . **J. Haworth Jonte**, associate professor of chemistry at the South Dakota School of Mines and Technology, to chairman of the department of chemistry. . . . **James Parkhouse**, chairman of the department of anaesthetics at the University of Manitoba, to postgraduate dean of medicine at the University of Sheffield, England. . . . **Benjamin E. Clark**, head of the department of seed investigations at the U. S. Department of Agriculture, to assistant director of Cornell University's New York State Agricultural Experiment Station. . . . **Robert N. Kreidler**, a vice president of the Alfred P. Sloan Foundation, to executive vice president of the foundation. . . . **Gerald P. Murphy**, assistant professor of urology at Johns Hopkins School of Medicine, to assistant director for clinical affairs at Roswell Park Memorial Institute; he succeeds **William H. Wehr** who has retired. . . . **P. D. McTaggart-Cowan**, president of Simon Fraser University, to executive director of the Science Council of Canada. . . . **Birgit Vennesland**, professor of biochemistry at the University of Chicago, to director of the Max Planck Institute for Cell Physiology in Berlin. . . . **Wallace P. Rowe**, head of the viral oncology section in the Laboratory of Viral Diseases at the National Institute of Allergy and Infectious Diseases, National Institutes of Health will keep this position and also become chief of the laboratory.