fiscal year represents a substantial increase over the $6 million available this year, but pales against the rough estimates made in a major NSF staff report last year that a total of over $400 million would be required over the next 3 years to deal adequately with the problem.

NSF officials, however, expect to use the $20 million in ways that will increase the agency's "leverage." The portion of the funds earmarked for buying computer time is expected to make the equivalent of one supercomputer available to university researchers next year. The balance of the money will go into what NSF terms local facilities—such things as minicomputers, personal workstations, and even assistance to campus computer centers to help researchers plug into large-scale computing facilities more effectively. In addition, NSF says it will be stressing cost sharing to boost the buying power of its grants, working to improve coordination with other federal agencies concerned about advanced computing, and also promoting cooperation with industry and encouraging donations of funds and equipment from it.

To help fashion a grand design, NSF has formed a blue-ribbon advisory committee for advanced scientific computing. The committee is chaired by Neal F. Lane of Rice University and has a membership, which includes Wilson, of computer knowledgeables from industry, the national laboratories, and universities. After its organizing meeting in late January, the committee issued a statement that put clearly on record its view of the importance of the issue. Setting things in broad perspective, the committee observed that "science is undergoing a structural transition from two broad metholodogies to three, namely from experimental and theoretical science to include the additional category of computational and information science. A comparable example of such change occurred with the development of systematic experimental science at the time of Galileo."

And in a concluding reference to budget considerations, the committee dismissed the projected funding levels as inadequate and boldly asserted that "we believe that computational science and information science should eventually have about equal priority and funding levels with experimental and theoretical science."—JOHN WALSH

Despite Doubts RAC Moving to Widen Role

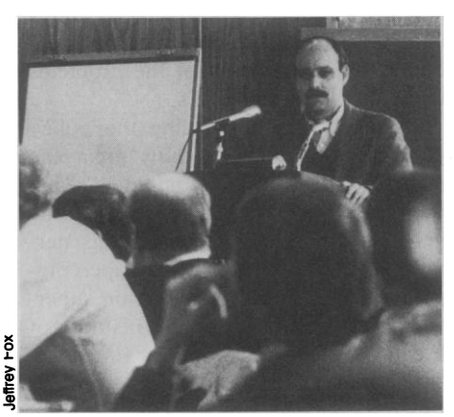
An odd mix of harsh criticism, legal maneuvers, and eulogies gave the latest recombinant DNA meeting a nostalgic air

The recombinant DNA Advisory Committee (RAC) of the National Institutes of Health faces a mixture of supporters and critics that change as fast as the technology it oversees. Their collective clangor during the 6 February meeting conjured memories of circus-like sessions a few years ago.

But something more serious is afoot, as evidenced by who is voicing concerns for RAC's future role. For example, NIH director James B. Wyngaarden has asked the committee to consider more closely limiting its sphere of interest (*Science*, 6 January, p. 35). Representative Albert Gore, Jr. (D–Tenn.), in a recently completed report, suggests that the Environmental Protection Agency should take over NIH's de facto regulatory authority in dealing with many biotechnology issues. And activist Jeremy Rifkin has been barraging RAC with manifestos and legal actions, questioning the committee's legitimacy but also trying to use its offices to slow the pace of biotechnology.

Despite these challenges, RAC not only decided to maintain its current responsibilities but to enlarge its sphere by reviewing proposed genetic engineering experiments in humans. In so doing, RAC took its cue from the President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research, which concluded in 1982 that oversight in this field was "desirable" and that an appropriately constituted RAC might fill that need. Concluding that no other national body is dealing with the ethical questions involved, RAC will expand its expertise to review voluntarily submitted proposals on a case-by-case basis.

Most visible among RAC's current critics is Jeremy Rifkin, president of the Foundation on Economic Trends in Washington, D.C. Accompanied by the foundation's attorney, he came before RAC to raise issues ranging from the wording of subheadings in the DNA guidelines to RAC's alleged lack of formal procedures in handling environmental matters under the National Environmental Policy Act. He also charged that RAC members are "personally responsible" for any war crimes arising from use of biological weapons whose development they indirectly abet (see box). Although RAC gave Rifkin many opportunities to voice his opinions and make suggestions, it consistently voted against most of his recommendations.



Jeffrey Fox

Rifkin: a barrage of criticisms

Nonetheless, Rifkin registered at least one important legal victory over RAC. On the day of the meeting, the U.S. Court of Appeals reversed a District Court decision and stopped RAC from discussing a proposal from Advanced Genetics Sciences to release genetically modified bacteria into an agricultural test field. The court said NIH must demonstrate "fully and prospectively" why any portion of the RAC meeting should be closed. (The court ruling was limited to the technical matter of justifying why part of the meeting should be closed.)

The company's proposal is similar to experiments planned by Steven Lindow and his colleagues at the University of California, Berkeley. Lindow's experiments, which are funded by Advanced Genetics Sciences and which seek to protect crops against frost damage using engineered bacteria, have been approved by RAC but were postponed indefinitely by the university after Rifkin threatened legal action to halt them (*Science*, 21 October 1983, p. 309). If the company's

new proposals had been considered and approved by RAC, Rifkin would have to challenge the company directly to stop the field tests. The court's decision prevents RAC from considering the company's proposals until June and means it cannot do any RAC-approved experiments until next fall at the earliest. The company is not legally obliged to seek RAC's advice or approval, and thus some observers say that Rifkin's maneuver may discourage other companies from submitting their proposals to the committee.

A wider debate about RAC's role, particularly in judging experiments to release genetically engineered organisms into the environment also is continuing. Rifkin and his attorney, for example, claimed at the meeting that RAC has been violating the National Environmental Policy Act. Rifkin's foundation has a lawsuit against RAC, NIH, and the Department of Health and Human Services pending on this issue. The suit is being defended by NIH, which says it is outside RAC's scope to interpret that act.

Similar concerns about RAC's role in this area are now being raised by members of Congress. Representative Gore just completed a report, "Environmental Implications of Genetic Engineering," which he submitted to RAC too late for the committee to do more than acknowledge its receipt. Gore's report recommends that NIH "cease its practice of evaluating and approving proposals for deliberate releases [of genetically engineered organisms] from commercial biotechnology companies." Furthermore, NIH should restrict its review to NIH-sponsored research.

The Environmental Protection Agency (EPA) "should proceed . . . to extend its authority," the report also says. Until EPA's position is clarified, an interagency task force should review proposals involving release into the environment of genetically engineered organisms. Meanwhile, no single agency should permit such releases until they are evaluated according to "a uniform set of guidelines to be developed by the interagency task force," the Gore report recommends.

Meanwhile, RAC has been moving to meet criticisms raised by Gore and others that the committee contains too narrow a spectrum of expertise. For example, RAC has added consultants or voting members to represent different specialties, such as microbial ecology. In that sense, RAC has been trying to undertake some duties of the interagency task force he is calling for.

Two new consultants to RAC are Martin Alexander of Cornell University and Frances Sharples of Oak Ridge National Laboratory, both of whom are ecologists. Neither is entirely happy with the way RAC has dealt with environmental issues. Alexander says flatly that NIH should not remain the lead agency when biotechnology may affect the environment, and that it should be replaced by agencies with, among other qualities, "competence, interest, and regulatory clout." Sharples's views are less extreme and echo what some of the regulatory agencies are saying about their own state of preparedness: "This committee [RAC] needs either larger representation or the burden shifted elsewhere," she said. "But EPA clearly is not prepared to take on the task at the moment."

The idea that an interagency committee could supplant RAC and that various agencies will take on the regulatory burden that NIH has been gingerly carrying seems to make sense. Yet RAC has proved itself adept—perhaps more so than any regulatory agency could have been—at dealing with some hotly argued disputes and at shifting its makeup to adjust to a rapidly changing technology. That facility lately has won RAC praise from representatives of the drug and biotechnology industries. Similar praise also is coming from representatives of federal agencies, including EPA and the Food and Drug Administration, who argue for RAC staying the "lead agency" on recombinant DNA issues for the time being.

So long as the dangers of recombinant DNA experiments remain hypothetical and until the regulatory agencies get their acts together, RAC's continuing prominence will be difficult to undercut.

—JEFFREY L. FOX

Shiga Toxin: No Smoking Gun

The most dramatic moments of the RAC meeting came when the committee dealt with a proposal that critics claimed could be related to bacteriological warfare. Leading the charge was Jeremy Rifkin, who issued ominous warnings about the committee's complicity in war crimes. Rifkin's warnings sounded rather farcical, however, for the proposed experiments are aimed at developing vaccines against dysentery, are not directly funded by the military, and will not be subject to secrecy.

Rifkin formally requested RAC to postpone action on a "Defense Department request" to clone a bacterial toxin gene "until an Arms Control Impact Statement has been done on this new technology, as required by federal law." Once again, as he has done on other issues, Rifkin assembled an impressive group of backers—this time leaders in the arms control community—to co-sign his request.

Rifkin's target is a proposal submitted to RAC by microbiologists Alison O'Brien and Randall Holmes from the Uniformed Services University of the Health Sciences (USUHS). They were asking RAC to change the physical and biological containment requirements for cloning the gene for a *Shigella*-like toxin (called Shiga) that is made by particular pathogenic varieties of *Escherichia coli*. Approval to conduct such experiments in a P-4 facility had been granted by RAC. But O'Brien and Holmes argued that strict containment no longer seems warranted because of how the toxin works.

O'Brien and Holmes, who both have civilian appointments at USUHS and whose support comes partly from NIH and the Agency for International Development, plan to develop a vaccine against the bacteria that cause cholera. Those bacteria not only produce cholera toxin but a Shiga toxin as well. The researchers would like to isolate the Shiga gene to figure out how it contributes to cholera and how to disarm it.

It is unlikely that anyone wishing to use the new genetic engineering techniques to design weapons would come before RAC for approval. Yet, "In authorizing the Shiga experiment and other similar experiments, the RAC becomes an active participant in the final uses to which the work is put," Rifkin said. "[I]f this experiment or any other experiment authorized by RAC is later modified and used for the specific purpose of developing and employing biological warfare weapons, each member of this committee would be personally liable. . . ."

The possible use of genetic engineering for developing biological warfare agents has concerned the arms control community for several years. This experiment hardly represents the best case for taking a stand.—**J.L.F.**