regular faculty should be involved in teaching beginning courses.

Bennett's critics do not argue with his basic pitch: that there is a core of common cultural knowledge necessary for the well-furnished mind, and that this core has been eroding dangerously. But critics feel he is hostile to new fields, such as women's and ethnic studies, and that his concepts of excellence are excessively rigid. Helen Moglen, English professor at the University of California at Santa Cruz, contends in an essay in *Profession 83*, a Modern Language Association periodical, that Bennett's vision of the humanities, in absence of more efforts to relate them to contemporary concerns, will only "contribute to the deepening sense of their irrelevance." His view, according to Moglen, is that "the common culture is not to originate with the people . . . but is instead to be imposed" on them.

In an interview with *Science*, Bennett noted that we are all products of Western civilization and should be familiar with its roots. He dismissed the criticism as coming from "people who aren't happy with Western civilization" and who consider it "political" to present it as being at the heart of the humanities. He is emphatically opposed to the notion that the fragmentation and pluralism of this country makes it impossible to arrive at a consensus on the relative value of thinkers and ideas. "We have been our own worst enemies here not to make a more forceful case for rationality," says Bennett. The fact is, he says in the report, the humanities "are not an educational luxury. . . . They are a body of knowledge and a means of inquiry that convey serious truths, defensible judgments, and significant ideas."

Bennett, a lawyer and a philosophy professor who came to NEH from the National Humanities Center at Research Triangle Park in North Carolina, has adopted an approach markedly different from that of his Democratic predecessor, Joseph Duffey, who encouraged innovation in both the substance and presentation of the humanities. According to the National Humanities Alliance, a lobby group set up in 1981 to fight budget cuts, Bennett is putting less emphasis on making humanities accessible to the general public and more on the refurbishment of the core disciplines, in both scholarship and teaching. His approach would appear to be in harmony with the back-to-basics trend at the Department of Education.—**CONSTANCE HOLDEN**

New R&D Centers Will Test University Ties

Interdisciplinary research labs are campus fixtures, but industry, government involvement gives a new twist

Since World War II, a rich variety of centers, institutes, and laboratories have been created in the cause of interdisciplinary research at American universities. By and large, universities have adapted successfully to these entities operating outside the traditional departmental structure. But the recent emergence of a significantly different second generation of extradepartmental organizations is causing some uneasiness.

Dubbed affiliated institutions for lack of a better name, these centers tend to be larger and better financed than their precursors. The major growth area is in the fields of biotechnology and computer science where the new enthusiasm for cooperation between universities and industry is at its liveliest. But what differentiates the new centers is that they are established and operated by mixed partnerships. The misgivings stem from concern that the agreements struck with partners from government and the private sector will blur the universities' traditional lines of administrative control.

The new centers differ widely from each other in form of affiliation and in function. Some examples:

• The California Microelectronics Innovation and Computer Research Opportunities Program (MICRO). Begun in 1981, the object of MICRO is to assist California's electronics and computer industries to bolster their competitive position by sponsoring research and graduate education in the fields at University of California campuses. The program is funded jointly by the state and industry.

• The electronics-industry sponsored R&D cooperative, MCC, in Austin, Texas. Chief among the inducements offered by the state to persuade MCC to locate there was the offer of close cooperation with the University of Texas and Texas A&M and a substantial buildup of the relevant departments at the two universities.

• The recent selection of Carnegie-Mellon University to operate a software engineering center for the Department of Defense (*Science*, 30 November, p. 1059) represents a prime example of a university undertaking to manage a major national center in a high tech area for a federal patron, in this case the Pentagon. Plans for the new software engineering center appear to call for closer links with campus activities than is common with other so-called FFRDC's (federally funded research and development centers) managed by universities.

• A Center for Advanced Research in Biotechnology (CARB) outside Washington, D.C. This project is under discussion by the National Bureau of Standards (NBS), the University of Maryland, and Montgomery County, Maryland, who are still engaged in negotiating the initial hurdles that such enterprises tend to encounter.

• The Whitehead Institute for Biological Science at Massachusetts Institute of Technology. MIT concluded an agreement with industrialist Edwin C. Whitehead under which he is providing construction and operating funds and a $100 million endowment when he dies. The new institute will be administered separately from MIT, but most researchers on its staff will be regular members of the MIT faculty. When MIT acceptance of the link with the Whitehead Institute was being debated (*Science*, 23 October 1981, p. 416), a main concern expressed by faculty was that, although MIT would have the usual right of approval of candidates for joint appointments to MIT and the Whitehead Institute, nominations would be made by the new institute and this could determine the direction of development of biology at MIT.

• A score of industry-university R&D centers are operating under the aegis of the National Science Foundation's Industry-University Cooperative Research program. NSF has wound up its participation in five older centers. The general view seems to be that an adequate mechanism for university control of the centers was included in the original design.

As some centers acquire independent status, however, there is a question of how they will evolve.

• State governments in many parts of the country are at some stage of establishing R&D centers linking industry to universities with a view to promoting economic development. The pattern varies greatly, with California's MICRO program presenting only one version of the initiatives. The schemes, however, seem to raise generic concerns for universities. Maintaining university control of appointments to the centers is a major one. Another is assuring that research projects are genuinely originated by faculty members and not adopted as a result of outside pressure, subtle or otherwise.

The new centers are clearly descended from the older type. If there is a common ancestor for today's interdisciplinary centers it is MIT's Research Laboratory of Electronics. It is itself the direct descendant of a research division of the World War II Radiation Laboratory at MIT, renowned for its work in the development of radar. The electronics lab was MIT's solution to the problem of transplanting to academe the combination of interdisciplinary work and federal funding that had worked well during the war. Cambridge was also the site of early initiatives in other disciplines such as the Russian Research Center at Harvard and the International Studies Center at MIT.

Subsequently, centers, institutes, and laboratories proliferated in public and private universities and in virtually all disciplines. The 1984-1985 *Research Center Directory* lists some 7500 nonprofit research organizations, a majority of which are university related.

The original seedbed of the interdisciplinary centers, MIT, has continued to be a pacesetter in their cultivation as they became a prominent feature on the academic landscape. Kenneth A. Smith, associate provost and vice president for research, says that when he recently compared the volume of research carried out in departments to that in the interdisciplinary centers he was surprised at the results. Of the total $218 million in research expenditures in the budget last year, about $81 million was accounted for by the departments. The rest went for work in the interdisciplinary labs and centers that reported either to deans of the various schools or to the provost.

Smith says that departmental research generally follows the traditional mode of an individual professor applying for a research grant and taking a major hand in the resulting research. In the interdisciplinary centers and labs, the scale of projects tends to be larger and teams of researchers are most often involved. Smith says that the share of the latter type is increasing steadily.

John Walsh will be on leave in 1985 to report on science and technology in development in Sub-Sahara Africa with the support of the Carnegie Corporation of New York.

In recent years, finding space for the centers has been an increasing problem. The federal government drastically cut back construction funds years ago, and donors tend to think in terms of gifts to departments. The centers also mean higher overhead costs since it is necessary to charge not only the usual institutional share, but to cover additional costs involved in operating the centers. At MIT, for example, a surcharge averaging about 5 percent is collected for the centers.

Like other university administrators, Smith acknowledges that centers do generate tensions and says that "turf issues get more complicated." He says, however, that MIT is "comfortable" with its interdisciplinary centers because it has stuck with some firm ground rules, mainly that academic appointments reside in the departments and that teaching is solely the responsibility of the departments.

The Whitehead Institute for Biological Science at MIT belongs to the emerging category of extradepartmental research centers currently pioneering new kinds of partnership on campus.

Long experience appears to have given MIT and most research universities a satisfactory modus vivendi with the traditional interdisciplinary labs and centers. But for U.S. universities, Smith says the new-style interdisciplinary centers are "a brand new phenomenon," and "it raises troublesome and legitimate questions."

Taking MIT's own Whitehead Institute as an example, he notes that "It does indeed require a dual commitment on the part of faculty members" with joint appointments at both university and the center. "The critics ask if it is possible over an entire career to maintain loyalty to two institutions." If the culture develops in such a way as to promote a sense of good citizenship and collegiality equally toward both, then "the enterprise will be seamless," says Smith. "If conflict develops, then it will be unstable."

Smith said that the Whitehead Institute is regarded at MIT as an important test of a relationship on new terms. He observed of the initiatives involving other universities that not just the issue of affiliation is involved but the question of the effects of maintaining sustained relations with state governments and industry. He said that the sensible way for universities to look at such new relationships is as experiments.

The University of California has some 40 years experience as manager of national laboratories, including the Livermore and Los Alamos nuclear weapons laboratories, and has some 100 interdisciplinary centers on its nine campuses. But a university official described the MICRO program as "unique." The program has a board of 12 divided evenly among members representing the state, industry, and the university. A carefully drawn set of guidelines is designed to protect university interests and academic integrity, specifying that proposals for research projects must be originated by faculty members.

For both NBS and the University of Maryland, the initial hurdles on the path to agreement on the Center for Advanced Research in Biotechnology have proved to be higher than expected. NBS saw CARB as an opportunity to carry out its responsibilities in respect to biotechnology instrumentation by working directly with industry and university partners. NBS patrons in the Senate, however, oppose agency participation in an effort that might confer a high tech advantage on industry in a particular area and on a single university. NBS was instructed in no uncertain terms in a

Senate Commerce Committee authorization bill report to come up with a plan that defined more clearly how such a joint venture would fit in with the agency's measurement mission and would give the endeavor a national rather than a local focus. A revised proposal is now in committee hands, but Senate staff sources say that approval of the project is by no means assured.

On the University of Maryland side, CARB was seen as fitting into a larger scheme as one of four separate institutes making up a comprehensive biotechnology initiative. The other institutes would be devoted to marine, medical, and agricultural biotechnology. As the first, however, CARB raised new issues. For example, the proposal apparently prompted the state board of higher education to seek assurances that the university was not taking unilateral action affecting academic credit and degrees over which the board has authority. But the major effect of CARB on the university stems from the recognition that existing policies were not adequate to cover participation in a joint venture in which the purposes of the various partners differ. A range of issues from rules for appointment to the staff of the center to dealing with patents and proprietary rights are under discussion. And the prospective partners are still working out a financial plan to govern industry affiliation. There is optimism among university officials that these prenatal problems can be worked out, but also a view that, as one of those involved put it, "We're trying to develop a new set of relationships. It's fair to call it an experiment."

Maryland went through something of a dry run on policy reformulation earlier this year when it vied for the Software Engineering Institute, which Carnegie-Mellon was selected to manage. During the competition period there were objections from Maryland faculty and students about the prospect of university involvement in secret research for the military. This raised echoes of the Vietnam protest era when several interdisciplinary research centers became targets of activists. There are faint rumblings of such protests on U.S. campuses now, and some so-far mild objections to the use of public resources represented by the universities for corporate advantage. But at this point, the main concern seems to be to protect the traditional university values and interests. And to do this, university officials with the most experience in this sphere emphasize that it is essential for universities entering new joint ventures to get the terms right.—**JOHN WALSH**

Garrison Compromise Proposed

A congressionally mandated commission, after 4 months of study, has submitted recommendations for substantial revision of the Garrison diversion project, a controversial irrigation program in North Dakota that environmentalists have been trying to scuttle for years (*Science*, 31 August 1984, p. 904).

The commission, manned mostly by western Republicans, has come up with a plan that at $1.1 billion is no cheaper than the original, but which would include $401 million in new money for industrial and municipal water delivery systems. Total irrigated acreage, authorized at 250 million, would be reduced to 130 million, including 17 million acres of Indian reservation to compensate for Indian lands inundated by the Garrison Dam in 1953.

The compromise would satisfy Canadians, who have expressed strong concerns about the transfer of Missouri River biota to the Hudson Bay watershed, by concentrating most of the irrigation in the James River watershed.

The commission calls for a halt to construction of the Lonetree Reservoir, the heart of the network, and its replacement by a canal. It states that the area, which contains a wildlife refuge, should be managed for wildlife but not put off bounds for future irrigation needs. The panel recommends permanent preservation of Kraft Slough, a prized habitat for migratory waterfowl and other species, which was scheduled to be inundated for a reservoir. It also advocates the formation of a panel of experts to oversee wildlife mitigation efforts.

The new proposals would rescue the project from a political stalemate. North Dakota politicians have been defending it fiercely for years despite declining public and congressional support. For the past few years plans have been limited to building "phase 1," which contains most of the costly and environmentally destructive infrastructure but which is only designed to irrigate 85,000 acres.

The Bureau of Reclamation is now free to proceed with the parts of the plan that are already authorized. Interior Secretary William P. Clark is expected to submit a request for those requiring congressional action by 15 February.

The commission exercise represents a unique solution to a major public works conflict. Environmentalists in North Dakota, who wanted the project deauthorized, are unhappy with the outcome. But the Audubon Society, leader of the anti-Garrison crusade, has expressed willingness to live with the modified plan, which it says reflects a more realistic response to the state's water needs.

—**CONSTANCE HOLDEN**

Industry-Academia Cooperation Touted

An extremely positive account of university-industry research projects is offered by the National Science Foundation (NSF) in a new report on its Industry/University Cooperative Research projects program (IUCR).*

The program, in operation since 1977, is "one of a very few federal efforts to create explicit bridges between the world of academia and the world of commerce," says the NSF, and there is little information on what makes such arrangements work.

So NSF mailed out 20-page questionnaires to 226 scientists working on 118 joint projects funded from 1978 to 1980, which covered basic research on subjects ranging from computer language systems to filtration processes.

The industry and university scientists showed broad agreement on the goals of research ("develop patentable products" was the most important) and were very pleased with its quality and with the synergistic effects of cooperation.

The report says the most important variables contributing to the success of the projects were "those related to interpersonal interaction." Most of the scientists involved represent the crème de la crème—senior professionals in major research universities and Fortune 500 companies. Collabo-

*"Cooperative Science: A National Study of University and Industry Researchers," from the Productivity Improvement Research Section, Division of Industrial Science and Technological Innovation, National Science Foundation, Washington, D.C. 20550, November 1984.