members and the board and OTA staff heads. However, Teague, in a reply typical of the power-wielder in such situations, said this might be "difficult" because congressmen are so awfully busy.

Whereas Brown's letter is a brief personal impression of how OTA is working, the commission's report is primarily a management study conducted by two auditors from the General Accounting Office, a part-time management consultant, and three staff members supplemented from time to time by other congressional staffers. It lambasts OTA for a host of alleged organizational, administrative, and definitional failings, including lack of "orderly structure," failure to delegate authority and responsibility (42 percent of the professional staff claimed they report directly to the OTA director), lack of a personnel program, defective accounting procedures, and poor internal communications, among other sins of commission and omission. Yet the report occasionally verges on self-contradiction and reaches hard to make the case that, while OTA has not yet been tripped up significantly by its administrative shortcomings, it may well find itself in trouble in the future.

After citing all the supposed organizational flaws, for example, the commission concludes that "To date, OTA has managed to minimize the more disruptive manifestations of its organizational and administrative weaknesses." Then it warns that, unless corrective action is taken, the flaws will limit OTA's long-term performance. Similarly, on the major concern that led to establishing the commission's study in the first place—the fear that OTA would duplicate the work being done by the General Accounting Office and the Congressional Research Service—the commission found no significant duplication among some 441 reports issued by the three agencies over a 7-month period. It attributed this record to "a high degree of sensitivity" by OTA program managers. Nevertheless, it warned that there is a "potential for duplication" because, while OTA has some procedures for avoiding duplication, it has no "established checklist" of steps to be taken to avoid duplication. In the eyes of some OTA supporters, the commission's critique reads like the view of management consultants who were more interested in organizational charts than in actual performance.

The only public response by OTA to the commission's criticisms was a bureaucratically opaque statement by OTA director Daddario, who called the critique "useful" and promised to study it carefully. "There is always a question as to how far a new, small, flexible agency should go in formalizing its procedures," Daddario said. "We welcome this contribution to that discussion."

—PHILIP M. BOFFEY

Recombinant DNA: Chimeras Set Free Under Guard

Guidelines governing research on recombinant DNA were issued in final form by the National Institutes of Health last month, bringing to close a 2-year period of debate-cum-moratorium during which most such research has been held in abeyance.

The guidelines do not differ in any serious way from the version agreed on 6 months ago by the NIH recombinant DNA committee (*Science*, 19 December 1975). They apply only to NIH grantees and do not have the force of law because the NIH does not at present intend to issue them as regulations.

An accompanying position paper prepared by NIH director Donald S. Fredrickson explains why certain objections to the guidelines have been ignored. One major criticism, advanced by Robert Sinsheimer of Caltech, is that the recombinant DNA technique compromises the barrier to genetic exchange which nature seems to have set up between bacterial and higher cells (*Science*, 16 April 1976). Fredrickson cites a counterargument to the effect that such exchange probably occurs all the time but is not detected because the organisms in question fail to survive. "The fact is that we do not know which of the above-stated propositions [Sinsheimer's or the counterargument] is correct," Fredrickson observes. The conclusion, while doubtless true, leaves Sinsheimer's theorem unrefuted and his objections, at least on their own terms, unanswered.

Another major issue in the debate has been the use of the human gut bacterium *Escherichia coli* as host for the recombinant DNA's. The two major critics of the guidelines, Sinsheimer and Erwin Chargaff of Columbia University, have both suggested that the host should be an organism which does not dwell in man or the human environment. (Besides man and warm-blooded animals, the known habitats of *E.coli* include fish, insects such as beetles, grasshoppers, and flies, and the soils of both densely and sparsely populated regions.) Fredrickson's response is that the wealth of existing knowledge about *E. coli* and its genetic makeup will make it a safer host than any other bacterium. Nevertheless, Fredrickson says, the NIH "recognizes the importance of supporting the development of alternative host-vector systems," such as those that have no ecological niche in man.

Measured against an absolute standard, the NIH guidelines may be less than foolproof on these and other points. Probably the fairer and more pertinent test of their acceptability is whether they faithfully translate into practical directives the general principles laid down at the international conference at Asilomar last year. The conference document, agreed to by all 150 or so delegates, and later adopted by the NIH recombinant DNA committee, stated that ignorance about the implications of the recombinant DNA technique "has compelled us to conclude that it would be wise to exercise the utmost caution." In the printed version of the document, which lacks the original's clarity of style, and possibly of definition as well, the five-man organizing committee of the conference has altered the words "utmost caution" to "considerable caution" (*Science*, 6 June 1975).

> Paul Berg of Stanford, a member of the organizing committee, says that no relaxation of standards was intended by the rewording, and that he sees "no substantial difference" in the change.

It could perhaps be argued that the NIH guidelines do not enjoin the "utmost" caution, because yet more cautious positions can be envisaged, such as avoiding the use of *E. coli* as a host*, or

*"You are . . . undoubtedly correct [in principle] that *E.coli* is the wrong microorganism," wrote DeWitt Stetten, NIH deputy director for science and chairman of the NIH recombinant DNA committee, in a letter of 6 October 1975 to a critic on this point. "Even at the Asilomar Conference, however," Stetten added, "I detected little interest on the part of the majority to table *E.coli* and begin again from scratch with some other organism. The enormous quantity of accumulated information about *E.coli* appeared to dictate that, despite its hazards, this was still the organism of first choice. . . . I should expect that were we to make regulations banning activity in this or any other field of science for a number of years, we should find these regulations very difficult or impossible to enforce."

requiring that the first round of experiments be directed toward settling specific issues bearing on safety. But the intent of the Asilomar conference was that the work should proceed under appropriate safeguards, and the safeguards recommended in the NIH guidelines are at least as strict, in some instances more so, than those outlined in the conference document.

This result was not achieved without effort. The first draft of the guidelines was generally weaker than the Asilomar document, so much so that Berg, a chief architect of the conference, complained to the NIH that one feature of the draft was "very likely to draw the charge of self-serving tokenism." A member of the NIH committee, Stanley Falkow of the University of Washington, Seattle, described another aspect of the draft as "tantamount to a hunting license for any hack or high school student to do these experiments with the blessing of the NIH."

In response to these and many similar criticisms, the NIH committee tightened up the guidelines to produce what is essentially the present version. The only important aspect in which the NIH guidelines still seem to be weaker than the Asilomar resolution concerns the surveillance of laboratory workers to see whether containment is in fact working. According to the statement agreed on at Asilomar, "It is strongly recommended that appropriate health surveillance of all personnel, including serological monitoring, be conducted periodically to estab-

Briefing

Coastal Zone: $1.2-Billion Energy Impact Fund Approved

On 30 June Congress completed action on a bill substantially increasing federal aid for coastal zone management and creating a Coastal Energy Impact Fund authorized to dispense up to $1.2 billion in loans and grants over the next 10 years. The impact money, which can be spent for a variety of public services and facilities (such as roads, schools, and hospitals), will help coastal communities accommodate the population growth and economic activity associated with development of outer continental shelf oil and gas and of facilities such as deepwater ports, refineries, and tank farms.

To make the bill acceptable to Secretary of Commerce Elliott Richardson and other Ford Administration officials, the primary emphasis in the Impact Fund was shifted from direct grants to bond and loan guarantees, although up to one-third of the $1.2 billion can still be given out in grants. Environmental lobbyists had been worried that the impact aid would needlessly encourage the siting of energy facilities in the coastal zone, but, as finally passed, the bill was acceptable to them as well.

Secretary Richardson, head of the interagency Energy Resources Council as well as the Department of Commerce, is now known to believe that the land management and energy impact aid concepts adopted for the coastal zone should be extended to interior regions that will feel the impact of various kinds of energy resource development. This suggests the possibility that the Administration may try to bootleg land use legislation—which many conservatives dispise—under the label of energy resource management.

Under the coastal zone program, a state becomes eligible for continuing financial assistance for its management activities once its program has been found to meet certain criteria as to its scope, balance, and supporting regulatory authority. And, once a state's program has been approved, all federal actions must be consistent with it.

The bill that Congress has just sent to the President would amend the Coastal Zone Management Act of 1972. It would give further impetus to coastal zone planning and management by the state and local governments by increasing the annual funding authorization from the present $45 million to $121 million, not counting a special one-time authorization of $50 million for planning which is specially related to the development of energy facilities. Only about $18 million was actually budgeted and appropriated for this past fiscal year.—L.J.C.

Toxic Pollutants: Court Approves Agreement

The Environmental Protection Agency is now legally obligated to undertake immediately a new comprehensive regulatory program for the control of toxic water pollutants. As part of this program, the EPA is to initiate this month a $20 million program of contract studies which will extend over the next 3 years.

The EPA commitment to the new program is set forth in an agreement negotiated between the agency and the Natural Resources Defense Council, the Environmental Defense Fund, and other organizations to settle several pending lawsuits (*Science*, 21 May). The environmental groups had sued the agency for its failure to meet certain deadlines and other requirements of the Federal Water Pollution Control Act (FWPCA) of 1972 with respect to toxic pollutants.

The settlement agreement became binding last month after its approval by Judge Thomas A. Flannery of the U.S. District Court of Appeals for the District of Columbia. Under the agreement, the EPA is supposed to have completed issuing effluent limitations and technology performance standards for the control of toxic pollutants before 1980. These limitations and standards are to be based on findings arrived at through the ambitious program of contract studies.

The studies will be of three kinds: some will have the aim of determining the ecological and health effects of the 65 toxic pollutants and classes of pollutants listed in the agreement; others will describe the present and developing state of control technology for each of 21 specified industrial categories; and still others will assess the probable economic impact on particular industries of requiring the "best available technology" (BAT) for the control of toxic pollutants.

Industrial polluters have all along been facing a 1983 deadline under the FWPCA for the installation of BAT. The studies and regulations called for in the new agreement will be directed specifically at the problem posed by toxic pollutants, which can be troublesome.

Most major industries will be affected by the agreement, and many industry groups urged Judge Flannery not to approve it (the National Coal Association, which signed the agreement, was an exception). They argued, in effect, that it seeks to get around the heavy procedural demands spelled out in a section of the FWPCA dealing with toxic pollutants.

So far, however, no industry or association of industries has given notice that it will appeal Flannery's decision. One attorney involved in the case on the side of industry told *Science* that such an appeal was unlikely. The agreement leaves industry free to challenge any or all of the specific regulations that the EPA will issue, and such challenges will no doubt be coming thick and fast.—L.J.C.

lish a base for epidemiological analysis." The printed version of the statement omits the adverb "strongly" and the reference to establishing an epidemiological base. The NIH guidelines say that the principal investigator is responsible for determining whether serological monitoring is appropriate, and make no provision for establishing the epidemiological base whereby the efficacy of the proposed containment measures could be established one way or the other.

A point that semantic quibblers and possibly others might raise concerns the definition upon which the NIH guidelines are based. The aspect on which the whole concern about recombinant DNA has been focused is that of joining the DNA from different organisms to create recombinants that may not have occurred before in nature. Such molecules have been called chimeras, after the mythological beast that was part lion, part goat, and part snake. The definition in the NIH guidelines is innocent of reference to this central issue. Instead, it defines recombinant DNA's by their mode of manufacture: as "molecules that consist of different segments of DNA which have been joined together in cell-free systems, and which have the capacity to replicate in some host cell. . . ." There is, perhaps, something intellectually unsatisfying in a definition that describes an object by the way it is made rather than by its essential properties.

The question of public participation in the guidelines is a matter of some relevance. The minutes of the NIH recombinant DNA committee record that at its first meeting, on 28 February 1975, the committee "specifically recommended that one lay representative be appointed." The recommendation was reaffirmed in May. Two new members joined the committee shortly thereafter, but both were scientists. Not until December was a lay member produced, and in public sessions, at least, he has contributed little. Representatives of public interest groups were invited to the hearing convened by Fredrickson in February. Some attended, but the serious criticisms of the guidelines continued to come from scientists rather than the lay public. The guidelines have not been significantly changed as a result of the February hearing, so that the public's effective input into the decision-making process cannot be described as substantial.

Public participation or not, the important fact is probably the guideline's relation to the Asilomar agreement. The Asilomar conference has been widely extolled as a responsible and disinterested act of self-regulation by the scientific community. It was also a hard act to follow, but the NIH guidelines will probably be judged to have succeeded in doing so, in as far as they stipulate safety precautions that are at least as strict as those envisaged at Asilomar.

Yet the immediate purpose of the NIH guidelines, to allow research to proceed under appropriate safeguards, is transcended by their probable historical role, that they sanction the use of a powerful heuristic technique likely to engender a quite new technology as well as a cornucopia of new knowledge. Even the nuclear era, despite the magnitude of its attendant benefits and risks, can be seen as just a continuation of man's development of his physical powers over nature. In making possible the creation of new forms of life, a prerogative hitherto reserved for evolution, the recombinant DNA technique may open the door to a technology of a different order. Considered in this context, the process being initiated may be one that is easiest to control at its outset and progressively harder thereafter. Nevertheless, the NIH guidelines probably represent as circumspect a beginning as could be hoped for.

—NICHOLAS WADE

Nuclear Proliferation (II): Will Fallout Kill Domestic Recycle?

The nuclear power referendum in California has come and gone, leaving in its wake some new legislation and a heightened sensitivity to nuclear issues. A little-noted aspect of that California legislation, however, is the requirement that commercial facilities to reprocess spent nuclear fuel be available before more power plants are built. Ironically, reprocessing to separate plutonium from the spent fuel and recycling that plutonium as fresh reactor fuel is emerging as the next major battleground in the war over nuclear power.

Opposition to domestic plutonium recycle has been led by environmentalists concerned about safety, environmental contamination, and nuclear terrorism. Now, it appears, arms control analysts concerned with nuclear proliferation and the international implications of domestic reprocessing of nuclear fuel are entering the fray, and there are signs that environmentalists are also beginning to raise this issue. Both groups are preparing to argue, in effect, that proceeding with domestic plutonium recycle will make it difficult, if not impossible, to persuade other, especially developing countries to forgo this step. Before proceeding, they contend, the United States should weigh the consequences of seeming to endorse a technology, the possession of which offers few if any economic benefits but lowers the price of entry into the nuclear weapons club.

The Ford Administration is coming under increasing pressure to adopt an uncompromising policy of opposing the spread of reprocessing technology abroad, but it has so far hesitated to do so. One source of this reluctance is almost certainly the awkwardness that would then attach to a decision in favor of reprocessing and plutonium recycle at home—to which both the government and the nuclear industry are at least officially committed. But the growing vigor of the debate over nuclear proliferation and the role of reprocessed plutonium (*Science*, 9 July, p. 126) is making it increasingly uncertain whether that commitment can be maintained.

The emerging concerns of the environmentalists and arms control analysts will find a forum in hearings scheduled later this year on the final environmental impact statement for domestic plutonium recycle, now in preparation by the Nuclear Regulatory Commission (NRC). The Commission is then scheduled to take up the question of licensing plutonium recycle sometime in 1977. Just how the decision will go and whether the licensing action will be superseded by a policy decision at a higher level of government is uncertain. But there are grounds for speculating that the nuclear proliferation issue and the incipient alliance of environmentalists and arms control analysts