not plan to mute its criticism of DNA research techniques but, like the NRDC members, the staff feel uncomfortable about tackling the leaders of biomedical research in their own territory.

The leader and still the most active participant in the environmental campaign to control research on DNA is Friends of the Earth. It helps an associated interest group called the Coalition for Responsible Genetic Research, directed by Francine Simring. The FOE is the only group that went to court. It has no plan to seek an injunction or any other obstructive action at this time. It has simply put its objections on file. The mere threat of legal action has pushed the government into taking some precautionary measures, however. One NIH researcher argues that FOE's purpose is to slow down research by any method available, simply because that is its business. If this is correct, FOE has been quite successful. The NIH has been tied up in knots of bureaucratic consultation and administrative legalisms over DNA for many months since the experts decided that the dangers inherent in their experiments were minimal.

Richard Hartzman, FOE's attorney, said that despite the criticism he has received from Lewis Thomas, Paul Berg, and Paul Ehrlich, FOE intends to remain active in biomedicine. Its president, David Brower, strongly supports the campaign to regulate DNA research.

Hartzman, Adams, and Highland view the scientists' protests as special pleading of a kind they have seen many times before, but never coming from such close friends. Hartzman said, "The experts always feel that they know what they're doing—look at the nuclear program. They can't make a judgment for us of what is an acceptable risk." Like other environmentalists, he said that the biomedical community is getting its first taste of public policy review and not liking it any more than the auto industry, the coal companies, or the pipeline builders did when it happened to them. Scientists who resent the interference in their work answer by saying that the outsiders are not so concerned with the public interest as they are with spinning out "procedural fluff" to keep themselves busy.

Who has the most authoritative claim to be a legitimate spokesman for the public interest in technical debates like this one? The scientists believe they are the best judges of what is wanted because they are best able to understand the risks and benefits of research and to predict the outcome. Yet the environmentalists claim to be better suited to speak for the public because, in theory, they have no vested interest in seeing that the research is speeded up or slowed down. They bring a global outlook which seeks to have the same principles of common sense and safety applied to every hazardous venture. However, as the critics point out, the environmentalists have a large stake generally in campaigns that slow the proliferation of technology, and they have a specific investment in slowing down recombinant DNA research. The public interest, *c'est moi*, Ralph Nader might say. And environmental activists sometimes seem to believe that the public interest is embodied in whatever they decide to do.

A couple of scientists wanted to know by what authority the environmentalists claim to speak for the common good. These private agents of the public interest are not elected, nor are they necessarily in touch with the views of rank-and-file members of the groups they speak for. The staffers who argued the case for restricting DNA research appear to have been somewhat casual about getting in-house support for their action. Dubos's letter and others suggest that even the trustees were not always kept up to date.

A survey of the groups mentioned earlier revealed that all three held executive meetings initially to decide whether or not to become involved in the DNA debate. But the more recent campaign to tighten research guidelines, which broke with the prevailing sentiment in the research community, seems to have received prior approval (though not trustees' approval) in two groups. In the third case, at NRDC, the policy is still in debate. What sort of democratic procedure do these groups use to include the membership in routine policy-making? The common response to this question was that members are kept informed through the newsletters.

If the environmentalists seem casual about soliciting lay advice, the scientists seem downright hostile to the idea. Many experts believe that nonspecialists are unable to understand the debate, much less contribute to it. For those who harbor such doubts, the DNA controversy confirms their belief that science does not benefit, but may suffer, when agitated citizens are invited into the inner sanctum. Maxine Singer argued, as she has throughout the DNA debate, that the environmental groups misunderstand or willfully misinterpret the nature of the debate. She believes that DNA research is fundamentally different from other enterprises in which the environmentalists become involved. Unlike pesticide manufacture or nuclear fuel processing, this research poses no proved hazards. The risks that are thought to be present exist only in the minds of the researchers themselves. They are purely conjectural, and Singer said that conjectures ought not to govern policy unless they come from the experts. If the environmentalists had proof that the by-products of recombinant DNA research had done some harm, then they would be right to sound the alarm. But no such proof is in hand, Singer argued.

Another scientist, who worked on the research guidelines, seemed most upset by the environmentalists' campaign to seat representatives of the public interest on the advisory boards at NIH and at the scores of sites where research is being done. These boards, which will be required to include at least two members each from outside the institution that sponsors the research, will be empowered to monitor and approve experiments. The guideline-writer shuddered at the thought of having political activists looking over the shoulder of reseachers all around the country. He doubted that any good would come of the public review requirements.

Although the gene-splicers may wish to withdraw and do their work in private, it is now impossible for them to do so, according to Halsted Holman, an immunologist at Stanford Medical School and a student of the sociology of science. He said, "There is no way they [DNA researchers] can change the momentum they have created." The public is not going to be kept out of the discussion on genetic engineering, which is what the recombinant DNA research portends. "It was inevitable that this would become a public matter," he said. Rather than running away from the controversy, Holman believes, scientists must learn to explain what they are doing and make a case for their work in popular terms. People who say that expertise must retreat when the politicians come near are "absolutely, totally wrong." They are doing science a disfavor, in his view. His most persuasive argument is quite pragmatic: scientists really have no choice but to answer public critics. If genetic research fulfills just a few of the promises now being made in its behalf, it can hardly avoid attracting public attention—a kind of attention that may make the environmentalists' interest seem tame.

—ELIOT MARSHALL

Erratum: In T. R. E. Southwood's review of *An Introduction to Population Ecology* by G. Evelyn Hutchinson (20 Oct. 1978, p. 301), the sentence beginning on the 19th line of the third-from-last paragraph should have read "Persons mentioned in the footnotes are included in the general index" rather than ". . . in the general text."