

**Where does the balance lie between freedom of inquiry and the public's role in science policy? An unprecedented interaction took place in Cambridge, Massachusetts**

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## **A citizen court in the recombinant DNA debate**

The complex problems growing out of scientific and technological advances have prompted many changes in the decision-making process within the institutions of science. The role for citizen review and public participation in decisions affecting technological change has expanded and institutional reforms have been made. These problems are also the basis of the increased anxiety and skepticism of the public toward science. Much of the anxiety can probably be traced to the disclosure of new environmental hazards. Skeptics question the objectivity of technical expertise and worry that personal and institutional values permeate the decision-making process. Increasingly, citizens are seeking access to the experts and assurance that their welfare and the welfare of future generations is not being compromised.

As changes develop in the relations between science and technology and within the institutions of science themselves, a period of adjustment can be expected. At what point does public accountability for the goals, the funding mechanisms, the research programs, the operations and applications of science begin to threaten the vitality of scientific institutions or impede their potential for authentic progress? Where does the balance lie between freedom of inquiry and the public's role in science policy?

This article shall examine an unprecedented interaction between scientists and the public that took place in Cambridge, Mass., from August 1976 to January 1977. The controversy began when anxiety developed over the renovation of a biological laboratory at Harvard University. Scientists were planning certain recombinant DNA molecule experiments which required a spe-

cial containment facility according to newly issued guidelines of the National Institutes of Health. Local citizens convened a panel or "citizen court" (a metaphor that I coined) to advise the City Council on whether the federal guidelines offered sufficient protection to the community.

Many questions have been raised about the Cambridge DNA controversy. Was this, for example, a singularly important event, a model for future controversies or was it simply an aberration in the evolving relations between science and society? The focus of this analysis, however, is to examine the concept of a citizen court as a strategy for the resolution of such technical controversies. And, as one of the eight citizens on the panel—called the Cambridge Experimentation Review Board (CERB)—my vantage point is that of a participant observer. From that perspective I shall discuss the form that this citizen review process took, its successes, its limitations, its potential for improvement, and its relationship with the more publicized "science court."<sup>2</sup> Before doing this, however, I believe it would be helpful to describe briefly the circumstances which led to the appointment of the citizen panel.

At the beginning of this decade several key advances in microbiology culminated in a new and powerful research technique that gave scientists the potential to map out the genome of organisms of higher-order species. A small but influential group of scientists (respected for their own contributions to the field of microbiology) identified a class of potentially hazardous experiments that promised to contribute to fundamental knowledge of life processes.

Several prominent biologists addressed an open letter to their col-

leagues calling for a moratorium on the experiments until an analysis of the risks were made.<sup>3</sup> An international conference was convened to develop guidelines for carrying out the new genetic experiments. The principal funding agency for the research in the United States, the National Institutes of Health, sponsored workshops which solicited criticism and recommendations from additional sources. After two drafts of the guidelines were reviewed, a third revision was adopted by the Institutes and subsequently promulgated as the guidelines for all recombinant DNA research funded by that agency.

Another wave of skepticism surfaced as scientists and environmentalists proclaimed the safeguards insufficient and criticized the NIH guidelines on the grounds that public input was excluded. Critics called for an environmental impact statement and for broadening the risk assessment by opening up the process to scientific experts in clinical medicine, ecology and infectious diseases.<sup>4</sup>

In the meanwhile, universities began developing plans for upgrading their existing laboratories so they would conform to the standards contained in the guidelines. After members of the Harvard biology department expressed concern about the plan for refurbishing a lab, the plan was brought to a broader sector of the university community for deliberation. After reading a news story describing this issue, the mayor of Cambridge called a special session of the City Council to gather information on the "new" Harvard laboratory. Frustrated by how the National Institute handled their objections, opponents of the research brought their views to the attention of Cambridge public officials. During the public hearings the issue drew



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overwhelming crowds to the council's chambers. Nobel laureates and other credible scientific spokespersons differed in their assessment of the dangers of carrying out recombinant DNA research in Cambridge.

Other scientific and technical controversies have become a matter of public debate, such as the siting of a nuclear power plant or the fluoridation of the water supply, but none of these issues begins to approach the complex and esoteric nature of the recombinant DNA debate. If nothing else, the language was enough to frustrate most mortals untrained in the discipline. The DNA controversy was not a likely prospect to test a citizen court.

There were several options available to the city. Since the debate was primarily between members of the academic fraternity, the Council could have thrown it back to the universities. But the universities had already had their hearings and failed to resolve the conflict. The Council could have referred the issue back to the federal authorities, requesting assurances that the community was in no danger. Or they could have placed a ban on the research until national legislation was passed covering all sectors of the society and assuring full compliance with the National Environmental Policy Act. Perhaps the most difficult option was the one the city chose, namely, to tackle the problem head on.

**This strategy was a compromise** between those who fought for an immediate ban on all recombinant DNA research and others who believed that the issues should be resolved by the scientists and their governmental tributaries. The model agreed upon—the task force or citizen review panel—was one that had been used on numerous occasions to handle politically volatile issues where the rights or interests of competing groups were in conflict.

Under Cambridge's form of government, the City Manager im-

plements policy, so he defined the composition of the review board. He used a combination of exclusionary criteria, suggestions from supporters and some special requirements.<sup>5</sup> In defining the review panel the City Manager made no distinction between those scientists who were publicly involved in the debate and other scientists in the biological field who were not. Furthermore, he decided against the option of selecting a board of scientists who were non-biologists but who had experience in making technical assessments of risk. (A panel of this type would fulfill the first requirements of a "science court.") The City Manager, who is steeped in political controversy as a routine matter, looked at the recombinant DNA issue in purely political terms. The City had nothing to gain from the research or the controversy, but it had much to lose if the controversy were continued or if the issues were exacerbated.<sup>6</sup>

A panel of eight residents was finally chosen to constitute the committee.<sup>7</sup> The members of the committee were all lay persons with respect to the biological research in question. Only one of the panel members had extensive biological training, a physician whose speciality is infectious diseases. As in any politically sensitive issue, the credibility of the panel to the community stands out as a concern. But the trade-off of credibility for expertise made it a very risky undertaking, because the possibility of lay citizens being frustrated with the complexity of the subject was as great a possibility as the likelihood that such a panel could be intimidated by technical experts.

**The citizen board convened** with a charge from the City Manager that restricted its investigations to evaluating the NIH guidelines and other issues pertaining to the health of the community. The social and ethical implications of the research were kept outside of its purview. In

the first three meetings there was considerable groping and a lack of direction. When it became apparent that there was no attempt to plan the process I issued a memorandum which appealed for some guidance on the objectives, status and procedures of the board.<sup>8</sup> This memorandum raised the notion of a citizen court to the panel for the first time.

I don't believe it should be the function of the Board to review "hard" or "soft" scientific data. The Board should rather be looking at the data as interpreted by experts. In this manner the Board as citizen-jury should be assessing the controversy within the scientific community on the issue in question. The function of this review should be, therefore, to try to understand where the locus of disagreement lies, whether on an issue of scientific merit or on a value laden issue, such as in the balance of the known risks with the potential contribution such research could offer.<sup>9</sup>

How much was the board able to capitalize on the analogy of a civil court proceeding? It was a strained analogy even on the presumption issue. Some individuals argued that justification rests with those who wanted to carry out the research. Other members of the board felt that the critics should be required to prove their case, namely, that the research is unsafe. They called upon the critics to present concrete scenarios illustrating how the public safety would be compromised. Otherwise it must be assumed that the scientists have a right to proceed in their work without interference from the community. That ambiguity over where justification rests continued throughout the proceedings of the citizen board.

The concept of a citizen court reinforced the idea that the board was involved in an adversary process. By requesting such a panel, the Cambridge City Council in effect asked Harvard and MIT to defend their research against the critics. During the

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three months that testimony was heard, defenders and critics of the NIH guidelines appeared voluntarily before the board on alternate weeks. During these sessions there was no opportunity for cross-examination of those testifying by their peers. It was left up to the citizens to carry out the questioning and cross-examination. Much of the board's education was obtained during this period.

As a dramatic culmination of its investigation, the board capitalized on the metaphor of the citizen jury by holding a court-like hearing. Harvard and MIT, through their biohazards committees, were asked to nominate a core team of between two and four scientists, with additional experts of their choosing to serve as resource persons. Local critics of the research were asked to form their team of experts. The "court" ran for 5½ hours in a cramped executive dining room in the neutral territory of the city hospital. The two teams were given the opportunity to make opening and closing remarks. Members of the citizen board prepared questions in advance and each of the eight citizens was allotted time to raise issues and cross-examine the scientists. After a scientist from one of the teams responded, additional time was offered to members of the opposing team to engage in some limited cross-examination.

Overall there was only a vague approximation between the citizen court in Cambridge and a civil court proceeding. Since there were no precedents for what occurred, the citizens had to establish their own procedures which they did without technical assistance. Nothing the board could do was legally binding and this freed it from any formal constraints such as rules of evidence. The review board, defined its own education agenda, selected the appropriate experts to testify. In a civil court there is a clear separation of responsibilities between the decision-making body, the referee or judge and the interrogators. The

eight-member review board took on all three functions.

Even with its limitations, the review process was an extraordinary expression of accountability by scientists to local citizenry on the potential hazards of the new gene splicing techniques.

In discussing some limitations of the citizen review process in Cambridge, the process can be examined operationally and structurally. The former relates to difficulties and shortcomings that were evident as the review process developed. These defects might be addressed by more careful planning, better education and improved access to technical expertise. A structural examination focuses on the very concept of a citizen court and whether it carries with it basic structural weaknesses in comparison with other strategies for resolving public policy debates.

In contrast to the science court, where the idea was created before it was tried, the citizen court was tried before it was recognized as a strategy for resolving conflicts. As a result, there was no way to anticipate the structural or operational weak-

nesses in the Cambridge review process. That process should not be viewed as a prototype but rather as a social experiment in its early stages of development. It has drawn attention from diverse interest groups, including those who see possibilities in a citizen court for defusing the polarization over nuclear power issues.<sup>10</sup>

The factors responsible for the outcome of the Cambridge citizen review were the planning of the process, the education of the lay citizens, the personal commitment of the members of the citizen panel, the time frame of the hearings, the availability and use of technical expertise and advisors. As a whole the review process could have been more efficient. Much time was lost in floundering over a perspective on how to proceed.

The education of the review board members was a major problem. Members became informed about the issues in three ways: reading material, testimony from scientists, and internal discussions. As a result it is unlikely that the citizens were exposed to the same information, since some individuals were more consci-



## Was the DNA controversy a fair test for a citizen court?

entious, had more time for reading than others, or simply could absorb more because of a prior technical background. While a line of testimony might have registered with one citizen, others who were not prepared with the appropriate explanatory model could not grasp the significance of the argument. The evidence for this is found in an examination of the types and frequency of questions posed by individual board members in the early stages of the hearings.

According to my diary account of the first month, only two board members (myself and an M.D.) directed scientific questions to the invited guests. On no occasion during that period did other members of the board build a line of inquiry on the technical questions and questioning would drift from the technical to the procedural sides of the issue.

No one who testified before the board was trained or prepared to present basic science to the lay public. Models of cell structure and gene activity were presented by scientists only at the request of board members. And there was a significant improvement in the comprehension of risk by lay citizens when the nature of gene structure, gene expression and gene exchange was illustrated through models.

Another constraint felt by the eight citizens on the Cambridge review board was time. The board met twice weekly for four months in sessions up to three hours long. In addition, I estimate that each member required on the average an additional four to six hours a week for reading the updated reports, technical documents and critiques, news articles and magazine stories which were handed out. As a result there was considerable imbalance in the type of preparation citizens received for the hearings.

The educational levels of the individuals did not seem to prompt different degrees of commitment: two had completed high school; two had achieved a baccalaureate degree;

one, a master's degree in social work; one, an M.D.; one, a master's degree in engineering; and one, a doctorate in philosophy. Under the circumstances, it would not be surprising to find high levels of frustration or feelings of intimidation and defeat by the sheer magnitude of the problem. Throughout the process I found no evidence of a defeatist attitude. There was a supportive and congenial atmosphere among the board's members.

Other factors influencing the outcome of the Cambridge citizen review was how its hearings were organized: who was chosen to testify and how the citizens interacted with the experts. When scientists began appearing before the board it took between three and four weeks before most of the citizens were able to articulate the most rudimentary questions on technical aspects of the controversy. Half of the board members never reached a point where they felt comfortable probing into technically sophisticated questions. Their input, not to be downplayed, focused more on procedural issues and regulation of the research. These included such questions as: Who will monitor the laboratories? Will the maintenance staff have entry to the research facilities? How will the technicians be trained? Who will review and authorize changes in the guidelines? Will epidemiological data be compiled on research workers? The citizens followed the norms of common sense and raised questions that were not resolved or detailed in the NIH guidelines.

The board did not plan its agenda of speakers in a systematic way. The choice of invited guests was made incrementally from week to week and was limited geographically since no operating budget was allocated by the City. While the board agreed to bring in representatives of opposing positions, that representation was not balanced in numbers. There was significantly more testimony from scientists who supported the newly issued NIH guidelines than from

those who were critical of them. Of the 20 meetings devoted to testimony on the NIH guidelines the breakdown of speakers was as follows: proponents, 12; opponents, 5; mixed, 3.<sup>11</sup>

Of the five meetings where criticism of the guidelines was discussed, one was devoted to a non-scientist from an environmental organization and another was a long-distance telephone interview of two board members with a prominent scientist-critic. Thus, if we examine the 20 meetings set aside for testimony, only *three* were devoted exclusively to the testimony of scientists critical of the research, who appeared in person.

The fact that the citizen board heard more direct testimony from supporters of the NIH guidelines could well be a reflection of the actual distribution of opinion in professional circles. But it is also a consequence of two important policies adopted by the board. The first was not to publicize the solicitation of speakers. By and large those who testified were invited through recommendations. Second, with one exception, people were not invited from outside the Boston region. This clearly restricted the number of experts who could have contributed to the process.

In addition to holding the court-like hearing, the board made one other quite innovative attempt to educate itself. A request was made of Donald Fredrickson, NIH Director, to participate in an open line telephone conversation so citizens on the review panel could direct questions to him about the guidelines promulgated by his agency. Fredrickson convened a panel of scientists and NIH officials to respond to questions raised by the board; the conversation lasted nearly 1½ hours.

Another constraint in getting technical people to deliver testimony on potential hazards is tied in with the attitude of scientists about public testimony. There is concern, which

## Can the citizen court be used for other technical controversies?

one hears expressed in cocktail party circles, that public scrutiny may spread to one's own work. The average researcher finds speaking before scientific panels more familiar ground than the uncertainties and publicity of the public forum. There is no way to know what effect these inhibitions had in limiting the pool of technical criticism. This cannot be neglected, however, as a possible structural limitation of the citizen court. There is a vast difference between soliciting scientists to offer expert testimony related to the industrial applications of a technology and soliciting testimony for the purpose of assessing potential hazards in academic laboratories.

The gathering of information through testimony and reports was only part of the citizen process. The information had to be organized, assimilated into a coherent form, and used to deliver a final report. When the review board was preparing to write up its recommendations, it utilized a method which insured maximum participation from the citizens and minimized the influence of any single individual. The technique, sometimes referred to by the term "charrette" called upon citizen board members to write their suggestions on large sheets of newsprint paper. Each idea was then included in a document that was sent out to board members for their consideration at a subsequent meeting. Through this mechanism, each citizen had the opportunity to consider a proposal for several days before it was accepted or rejected by the entire body. The charrette method made the final recommendations a truly collective effort since each citizen was responsible for at least one recommendation in the final document.

**Public policy decisions** often require sound scientific judgments. The purpose of a science court is to establish an institutionalized forum modeled on an adversary process for providing those judgments to the

policy-makers. The forum, as it has been conceived, would consist of a panel of scientist-judges. The judges would listen to case managers present the justification for scientific claims that have a bearing on a public policy issue under dispute. The panel of judges would eventually prepare a report on the disputed claims separating the verified factual claims from speculative judgments and false beliefs. The process assumes that there is a class of disputes in which value claims and factual claims are separable, and that it is desirable for public policy-makers to have the factual basis of the dispute laundered from other contaminants.

This brings us to the question: Could a science court have been useful in resolving the Cambridge recombinant DNA controversy? I believe that a science court might have been useful in supplementing the citizen review process but not a substitute for it. This is because of the special nature of the political climate in the city as well as the limitations of such a scientific panel in demarcating verified claims from tentative hypotheses and false beliefs.

During the board's hearings conflicts surfaced on interpretations of scientific data, the use of analogical arguments, the validation of theoretical claims related to risk, and meta-scientific issues pertaining to procedure and ethics. I shall cite one of the statements that elicited controversy during the debate just as an example of the limits of a science court.

There was much concern over the use of *E. coli K12* as the host organism of the genetic recombinations. Especially during early stages of the debate, the proposition that "*E. coli K12* cannot be transformed into a pathogen" was contested. Can the judges comprising a science court determine whether the proposition is a fact? Where it is acknowledged that there is data to support the proposition, it must be the judges who decide what level of

support determines that the proposition is factual. If scientists within the same discipline disagree over the conditions under which a given class of experiments establishes the validity of a proposition, why should a group of experts outside the field be able to determine that fact?

What are the facts in question? Suppose there is testimony before the science court that the experimental data offered to confirm a generalized statement was not of sufficient scope to justify an inductive generalization. Does the science court present *that fact*, namely, that different epistemological criteria are held by scientists for validating the controversial claim? Unless one is to assume that there are standard methodological norms such as disciplinary criteria for scientific induction, the judges will have to choose sides from among those adversaries who argue from different epistemological frameworks.

There is a danger in trying to divide the issues into factual and policy components. Disputes rooted in epistemological criteria may be masked from the policy-makers who would then be witness to an oversimplified presentation of the issues.

The use of a science court to the exclusion of a citizen review would not have been of considerable advantage to the City Council even on the technical side of the debate, since the policy issues were inextricably tied to issues of evidence and conflicting epistemological norms.

Critical studies which had unambiguous implications and were universally accepted became available to the Cambridge citizen board early in its investigation. The problem definition and the grey information—including the vastly different paradigms with which scientists interpreted the possibility of emergent events and the probability of the escape and proliferation of a pathogen—proved to be the key to the resolution of the issue.

While it may not be possible to iso-

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late the facts in a technical controversy, there are contributions that a science court could make to a citizen review process such as the one carried out in Cambridge.<sup>12</sup> The scientific judges could screen out the evidence, collect and interpret pertinent results, and make explicit to the policy-makers or citizen-jurors the operational norms of the science. For example, does a test utilizing a dozen human subjects constitute sufficient evidence for generalization? Is that a norm for the science? In this way the science court would function as the technical arm of the citizen court? I do not see two independent and consecutive processes. Those in the public-policy sector should be witness to the proceedings of the science court.

There are several reasons why one could call the work of the citizen board successful. It established its credibility with the community. There were no cries of "packed committee" or "special interests." The citizens were not provoked into acting on the basis of allegations about hidden motives. While there were Lysenkoist smears directed at critics of the research, they had no detectable impact on the proceedings.

Another success of the process is that lay citizens carried it through in a dignified and rational atmosphere. The process resulted in a report that was instrumental in resolving the controversy in the City's political arena. The board's final report and recommendations received the full backing of the City's Commissioner of Health and Hospitals. What was once a split vote in the Cambridge City Council over whether the research should be conducted was subsequently changed as the Council voted unanimously to support the board's recommendations.

In retrospect, the review board's decision was probably an optimum solution to the local controversy. It took a position somewhere between the status quo and banning the re-

search outright, with a strong emphasis on laboratory monitoring, public disclosure and broad participation in decisions of risk assessment. This was a compromise solution, in effect, without the citizens feeling that they had to compromise, since there were no personal interests in the research and therefore no trade-offs necessary for members of the citizen panel. In other words, it was not a negotiated settlement but rather a decision where the overriding concern was public safety.

Observers will undoubtedly ask whether the citizen review process in Cambridge for recombinant DNA research is unique to that community for that issue. Can we learn something from the experience? Can the model of a citizen court be developed for other technical controversies in other areas? What benefits are there to convening a citizen court rather than a panel of technical experts?

The most persuasive argument against a citizen court is that the decision-making body is not matched to the task. Another shortcoming is that lay citizens confronting scientific debates are more vulnerable to persuasion by extravagant but unsubstantiated claims than individuals with scientific credentials.

On the other hand, the conditions of controversy and the shape of conflict are so varied that it would be wise to have available several strategies. The citizen court is one among several emerging models for resolving technical environmental policy conflicts along with the science court, professional arbitration, technology assessment strategies, compromise, negotiated settlement, and public referenda.

The Cambridge experience while singularly successful should not lead us into believing that this type of strategy for the resolution of a technical controversy will be as successful in other instances. In this situation, some scientists may have wel-

comed the panel of citizens as an alternative to the charged atmosphere of the City Council chambers. But I have no doubts that a citizen panel comprised of highly trained scientists in the biological field would have had many advantages over a panel of lay persons for the recombinant DNA controversy. The committees established by Princeton University and the University of Michigan are cases in point. The final reports of those committees indicated that they probed more extensively into the technical debate than was accomplished in the Cambridge citizen review. There were deeper scientific questions raised in their hearings.<sup>13</sup>

Scientists serving on a review panel could undoubtedly use some of the time from their professional work to carry out an intensive investigation of the issues surrounding the controversy in a way that would be impossible for many lay persons. For citizens who work on a nine to five schedule, participation on a board involved in such an issue as the DNA controversy is extremely taxing.

Mixing lay people with scientists introduces other problems. When technical scientific issues are at stake citizens and scientists don't mix well. There is a strong tendency for the scientists to play a dominant and elitist role that intimidates lay persons. We can see evidence of this effect in the biohazards committee established by the Princeton Township and the Princeton Borough.

One can anticipate that a science court would be more forceful in its investigation and less prone to intimidation by expert testimony than a panel of lay citizens. Why, then, consider a lay citizen court when a panel of scientists acting in their community's behalf appears more sound? There are conditions under which a lay citizen body would be more desirable. Some of these conditions existed in Cambridge during the recombinant DNA debate:

- Where the political climate is

## The purpose of the citizen court is to examine and assess a controversy when the experts disagree.

such that a jury of scientists would be viewed by the public as self-serving.

• Where scientific experts from fields allied to the issue under debate have a special interest in seeing the research move along swiftly.

• Where scientists are likely to concern themselves with the impact of the technology or research in question to the growth of the university or other scientific institutions.

• Where the issues involve increasing governmental regulation in a branch of scientific activity, local scientists may see the move as setting precedents that could affect their own research.

• Where the technical issues and the policy issues are inseparable and a cross-section of community attitudes is seen as important in the final decision.

• Where a panel of technical experts is likely to define the problem too narrowly, failing to consider the social implications of the science in question.

The purpose of the citizen court is not to replace or duplicate the analysis of technical experts. Its principal function is to examine and assess the locus of controversy when scientific experts disagree. It is a means by which scientists—who question the wisdom of prevailing policies affecting the public health and safety, who are frustrated with the internal politics of professional societies and regulatory agencies or who feel that the full dimension of the problem has not been considered—can have recourse to another forum.

1. The events of the Cambridge recombinant DNA controversy have been partially chronicled in the following articles: William Bennett and Joel Gurin, "Science that Frightens Scientists," *The Atlantic Monthly*, 239 (February 1977), 43-62; "The Cambridge Experimentation Review Board," *Bulletin*, 33 (May 1977), 22-27; Robert Karl Manoff, "A Citizen's Panel Takes on Cambridge Scientists Over DNA Research," *Seven Days*, 1 (March 28, 1977), 27-28; Gurin and Bennett, "Citizens and Scientists: Cambridge Review Board Begins Deliberations," *Harvard Mag-*

*azine*, November 1976, pp. 15-16; Barbara J. Culliton, "Recombinant DNA: Cambridge City Council Votes Moratorium," *Science*, 193 (July 23, 1976), 300-301; Nicholas Wade, "Gene Splicing: Cambridge Citizens OK Research but Want More Safety," *Science*, 195 (Jan. 21, 1977), 268-269.

2. For a discussion of the science court concept, see Arthur Kantrowitz, "The Science Court Experiment: Criticisms and Responses," *Bulletin*, April 1977, pp. 44-53; Kantrowitz, "Controlling Technology Democratically," *American Scientist*, 63 (Sept.-Oct., 1975), 505-509; Dorothy Nelkin, "Thoughts on the Proposed Science Court," in *Newsletter on Science, Technology & Human Values*, (Aiken Computation Laboratory, Harvard University), No. 18 (January 1977), 20-31.

3. This letter, referred to as the Berg letter, was published in the July 26, 1974 issue of *Science*. The letter was signed by Berg (chairman of the National Academy of Sciences' Committee on Recombinant DNA Molecules Assembly of Life Sciences), David Baltimore, Herbert W. Boyer, Stanley N. Cohen, Ronald W. Davis, David S. Hogness, Daniel Nathans, Richard Roblin, James D. Watson, Sherman Weissman, and Norton D. Zinder.

4. See Francine Simring, "Folio for Folly: N.I.H. Guidelines for Recombinant DNA Research," *Man and Medicine*, 2:2 (1977). Ms. Simring is chairman of the Friends of the Earth Committee for Genetics, and the executive director of the Coalition for Responsible Genetics Research.

5. The City Manager's own account of his decision was made part of the public record:

There were those who felt that the board should consist of both proponents and opponents to the experimentation and some neutral citizens. After some deliberations I rejected this position because it would tend to set up antagonistic positions on the committee whose approach would be to sway neutral members. Others felt that since the experiments to take place were of a scientific nature and extremely complex that the committee should consist of knowledgeable scientists, biologists and geneticists who would approach the problem scientifically and come to a conclusion. I rejected this approach as well because this issue is before us because of a dispute within the scientific community as to the hazards involved and it would be extremely difficult to find knowledgeable scientists who did not have preconceived views on the subject. (James L. Sullivan, City Manager, Cambridge, Mass., to Cambridge City Council, Aug. 6, 1976.)

See also the appendix of "Guidelines for the Use of Recombinant DNA Molecule Technology in the City of Cambridge," Jan. 5, 1977. For a collection of documents issued by different sectors of the city government, see

"The Recombinant DNA Controversy," Oral History Collection, Institute Archives, Massachusetts Institute of Technology.

6. It was the mayor, Alfred Vellucci, who led the opposition to the research in the City Council; he had established an unorthodox coalition of support within the Cambridge academic community. The mayor's motivation for pursuing this issue in a public forum has never been established, though the following explanations have been advanced. First, the mayor was capitalizing on the opportunity to ruffle Harvard's and MIT's feathers and to exploit the town-gown rift that has been identified with his constituency. Second, the mayor, a 23-year veteran in the City Council who nearly lost his bid in the previous election, needed the publicity to improve his vote in an upcoming election. Third, after consulting local scientists, the mayor feared that the research would unleash some insidious germs into the community. The City Council elections of November 1977 showed no signs that the DNA issue played any role in electing candidates.

7. Strictly speaking, one member of the citizen's board did not have his residence in Cambridge; he lived in an adjacent community but maintained his medical practice in the city.

8. Internal memoranda issued by the Cambridge Experimentation Review Board are on file at the MIT Oral History Collection, Institute Archives.

9. MIT Oral History Collection.

10. Harold Federow has examined the Cambridge review board for its potential application to the nuclear controversy in an unpublished paper "Recombinant DNA in Cambridge: Lessons for Nuclear Energy," Occasional Paper, Sept. 1977, The Institute for Energy analysis, Oak Ridge Associated Universities, Oak Ridge, Tenn.; for a shorter version, see Federow, *Bulletin*, Feb. 1978, pp. 6-7.

11. By proponents I mean those individuals who supported the status quo or less regulations; by opponents I mean those individuals who believed that the NIH guidelines did not offer adequate protection against the potential hazards of the research. In the mixed category I include those meetings in which opponents and proponents participated together or in which the person testifying took a middle of the road position.

12. Nelkin, *Newsletter on Science, Technology & Human Values*.

13. At Princeton University, a subcommittee chaired by Robert M. May issued its "Recommendations for the Conduct of Research with Biohazardous Materials at Princeton" on Dec. 6, 1976. At the University of Michigan, a faculty committee reviewed the research being carried out and issued its report of "The University Committee to Recommend Policy for the Molecular Genetics and Oncology Program (Committee B)" in March 1976.