

Public Perceptions of Agricultural Biotechnology: A Survey of New Jersey Residents

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Suggested Citation:

Hallman, W. K., & Metcalfe, J. (1994). Public perceptions of agricultural biotechnology: A survey of New Jersey Residents. Food Policy Institute, Cook College, Rutgers, The State University of New Jersey. Available on the World Wide Web at: www.foodpolicyinstitute.org.

This report was originally distributed by the Ecosystem Policy Research Center, Rutgers, The State University of New Jersey.

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Acknowledgments

Dr. Hallman would like to thank the many experts from Rutgers University involved in the design, execution, and report of this study. These included: Dr. Laura Meagher, Center for Agricultural Molecular Biology; Caron Chess, Director of the Center for Environmental Communication; Ms. Janice Ballou, Director of the Center for Public Interest Polling of the Eagleton Institute of Politics at Rutgers University; Dr. Mark Lapping, Dean, Edward J. Bloustein School of Planning and Public Policy; Dr. Daniel Rossi, Assistant Dean, Cook College; Dr. Donald Schaffner, Food Safety Specialist, Rutgers Cooperative Extension Service; Ms. Clare Liptak, Extension Specialist, Rutgers Cooperative Extension Service of Somerset County, Mr. Daniel Strombom, Extension Specialist, Rutgers Cooperative Extension Service of Cape May County. Thanks also to Dr. James Laughlin of the Department of Psychology of the University of South Carolina, who helped to answer questions about using inferential statistics on weighted data. A special note of thanks to Dr. Roger Wyse, former Dean of the New Jersey Agricultural Experiment Station and Dr. Mark Lapping, Dean of the Edward J. Bloustein School of Planning and Public Policy who were both instrumental in securing the funding for this study.

Executive Summary

Biotechnology is expected to produce significant economic and environmental benefits as a result of the development of new varieties of plants and animals and improved agricultural productivity. Seen by many as a key technology for the 21st century, and as an economic stimulus for the State of New Jersey and for the Nation, biotechnology has been the subject of intense scientific and public debate. Yet, while experts and activists continue to argue, genetic engineering techniques are already leading to agricultural products that may soon be on supermarket shelves.

Despite the imminent introduction of genetically engineered agricultural products into the marketplace, little published research has detailed how American consumers actually feel about biotechnology or its products. To assess public perceptions in New Jersey about both biotechnology and potential agricultural products created through biotechnology, a telephone survey was commissioned by Rutgers University in May 1993. The survey was conducted with a random sample of 604 New Jersey residents, through the services of the Center for Public Interest Polling of the Eagleton Institute of Politics at Rutgers University. The key objective of the survey was to examine the beliefs, attitudes and intentions of New Jersey residents toward agricultural biotechnology and its products. This paper provides a brief summary of relevant prior studies; presents the data obtained from the present survey; and explores some policy implications of the survey's findings. When interpreting the results of the survey, it should be noted that the sampling error associated with a statewide sample of 600 people is approximately ± 4.0 percent at a 95 percent confidence interval.

The survey found that one quarter of New Jersey's citizens (25 percent) rate their understanding of science and technology as "very good" and an additional 55 percent say that their understanding is "adequate." **New Jersey's residents rate their understanding of science and technology much higher than respondents in national surveys.** For example, in a national survey carried out by the Office of Technology Assessment (OTA) in 1986, only about one in six Americans (16 percent) rated their basic understanding of science and technology as "very good."

The survey found that awareness of biotechnology among New Jersey's residents is slightly higher than that found in national surveys. Nearly half the New Jersey population (48 percent) had heard or read "some," or "a great deal," about genetic engineering. Awareness was greater among men, people with more education, and those who think they have a very good understanding of science and technology. Statistical analysis showed, not surprisingly, respondents who work as scientists or engineers, or who belong to a scientific group or organization, were more likely to have heard or read about genetic engineering. Similarly, those who said that they belonged to environmental or consumer groups were more likely to have heard of genetic engineering. However, medical professionals and those whose jobs involve growing food were no more likely to have heard of genetic engineering than other respondents. Those whose jobs involve preparing or selling food were less likely to have heard of genetic engineering than other respondents.

When asked to report their first thoughts or images upon thinking about genetic

engineering, it was evident that many people have not spent much time thinking about the subject. More than one-in-four people (26 percent) could not say what their first thought or image is when asked to think about genetic engineering. The most popular single response (12 percent) was related to science, scientific equipment or high technology. This was followed by images of test-tube babies, embryos, cloning, and the book Brave New World (10 percent). **However, nearly one-in-five people (19 percent) had essentially negative first thoughts or images about genetic engineering, responding with words like: "frightened," "bad," "don't approve," "mutilation," "escaping virus," "cancer," "disease," "Nazi/Hitler," "mad scientist," "mutants," "monsters" and others.**

Not all of the public's first thoughts or images concerning genetic engineering are negative however. **Beyond images of science, nearly one quarter (24 percent) of the respondents first thoughts were essentially neutral.** Such thoughts included: DNA, chromosomes or molecular biology, crossbreeding, God, creation, and life, and general thoughts about plants, animals, people, and other images. **Some of the public's first thoughts about genetic engineering were also quite positive although these were less frequent than either negative or neutral images.** About 8 percent of the respondents mentioned: "medical advances," "progress," "safe," and, "natural."

The survey found that most New Jersey residents (91 percent) felt they had an "adequate" or "very good" understanding of how food is grown and produced. However, much of the public was unfamiliar with traditional methods for producing hybrid plants and animals. While over half the population (54 percent) acknowledged that they had heard of cross-fertilization or cross-breeding, only 28 percent said they had eaten a fruit or vegetable produced by this method. This is quite surprising since most fruits and vegetables commercially available are the products of these traditional hybridization techniques. **What is even more surprising is that 17 percent of the population believes that they have eaten a fruit or vegetable produced by genetic engineering, though no such product is yet available to consumers.**

Most of New Jersey's citizens (59 percent) approve of producing hybrid plants by using traditional cross-fertilization techniques. However, one in five people (20 percent) believes that it is "morally wrong" to produce new plants in this way. Producing hybrid animals through cross-breeding is viewed even more negatively. Most people (62 percent) in New Jersey disapprove of producing hybrid animals using this method and half (50 percent) believe that it is "morally wrong." While the number of people who say they disapprove of traditional crossbreeding techniques is, at first, surprising, similar numbers of people were found to disapprove of these techniques in national surveys.

Differences in the acceptability of hybridizing plants versus animals using traditional methods of crossbreeding are also reflected in the views that people have about hybridization using biotechnology. **A majority (61 percent) of New Jersey residents approve of using genetic engineering techniques to produce new plants but less than one third (28 percent) approves of using these techniques to produce new animals.** While people who approve of producing genetically engineered animals are also likely to approve of producing genetically

engineered plants, the reverse is not true. Almost half (49 percent) of the people who approve of the use of genetic engineering for plants do not approve of using it for animals.

People's views concerning the hybridization of plants and animals were relatively consistent, whatever the techniques used to bring it about. People who approve of traditional cross-breeding methods for producing hybrid plants are also likely to approve of producing hybrid plants through genetic engineering. The same is true for producing hybrid animals. **Objections to producing hybrid organisms appear to lie more with the organisms involved (manipulation of plants or animals) rather than the process involved.**

Most people in New Jersey do not want to turn the clock back on biotechnology. Only 19 percent of those surveyed agreed either strongly (12 percent) or mildly (7 percent) that it would be better if we did not know how to do genetic engineering at all. A sizable majority (58 percent) of the public in New Jersey also disagreed with the statement, "we have no business meddling with nature."

Most of New Jersey's citizens seem to be in the initial stages of making up their minds about this new technology and have not decided that products of agricultural biotechnology are universally acceptable or unacceptable. The survey examined whether public acceptance of the application of biotechnology differs with respect to specific products. Most respondents supported ten of the twelve products asked about. **Support was given for genetically engineered products related to: human health and welfare, saving money or time, and the environment.** The strongest support was given to items regarding human health. For example, most of the New Jersey population "strongly" (81 percent) approves of creating new drugs to cure human diseases. A similar proportion of the population supports the creation of hormones like insulin that help those with diabetes. There is also strong support (68 percent) for genetically engineering "more nutritious grain that could feed people in poor countries." New Jersey's residents would also welcome genetically engineered bacteria that can help clean up oil spills. **However, most of the population in New Jersey is against developing genetically engineered hormones that can either help cows produce more milk or help cows produce more beef.** About four out of ten New Jersey residents strongly oppose the development of such hormones using genetic engineering.

Acceptance of genetically engineered products does not appear to be clearly determined by feelings of morality. For example, 62 percent of people who strongly disapprove of producing bacteria to clean up oil spills do not think it is morally wrong to genetically engineer plants. On the other hand, more than four-in-ten (42 percent) who approve of producing a hormone to help diabetics also believe it is morally wrong to genetically engineer plants. There are similar results for approval of a new grass that does not need to be mown so often, approval of new drugs to cure disease, and approval of more nutritious grain to feed people in poor countries. Clearly, people's views about genetic engineering may vary when a specific product is described. **People appear to be far more focused on the characteristics of products than the process used to create those products. People may be willing to overlook their objections to genetic engineering if its products produce specific benefits.**

About one-in-four of New Jersey's residents (24 percent) say they sometimes shop in "natural" or "organic" food stores, and about half (49 percent) of the population reports having seen fresh fruits or vegetables labeled "organic" or "pesticide free" in the places where they normally shop. **Not surprisingly, much of the population in New Jersey feels that it is "very important" (37 percent) or "somewhat important" (37 percent) that the fruits and vegetables they eat are grown organically.** However, nearly 67 percent say that most, if not all of the produce in the stores where they normally shop was treated with pesticides at some point. Only about two percent said that none of the produce in the stores where they shop was treated with pesticides.

Most of the population (85 percent) agrees that "growing genetically engineered plants that contain higher levels of naturally occurring chemicals that protect against pests and disease is better than using pesticides." However, while a majority (55 percent) of those surveyed agreed that "food that is produced from genetically engineered plants that contain higher levels of naturally occurring chemicals that protect against pests and disease should be considered *organic*," a similar proportion (54 percent) agreed that food produced from such plants should not be sold in 'natural' food stores. More than nine-out-of-ten (91 percent) of those who agree that such genetically engineered food should be considered organic also agree that this food should not be sold in natural food stores. This suggests that **while most people see a potential "organic" benefit from the genetic engineering of fruits and vegetables, they clearly do not see such products as "natural."**

Most of New Jersey's population (84 percent) also thinks that fruits or vegetables created by genetic engineering should have special labels on them. The preference for such labels seems to stem more from the consumer's desire to make an informed buying decision rather than to avoid genetically engineered foods. Sixty percent of the population would consider buying fresh vegetables if they were labeled as having been produced by genetic engineering. **Similarly, people are also very much in favor (76 percent) of farmers voluntarily putting labels on their produce that say they were not genetically engineered.** However, fewer people (58 percent) would spend the time while shopping to look for such labels. Again, informed choice and not avoidance, seems to be the motivation. Forty-two percent of the people who said that they would look for produce labeled "not genetically engineered" also said that they would buy produce that was genetically engineered if it were labeled as such.

Peoples' willingness to purchase genetically engineered products differed depending on the specific agricultural product involved. For example, far more people said that they would be very willing or somewhat willing to buy genetically engineered apples (55 percent) than genetically engineered baby food (27 percent).

Over two-thirds of New Jersey's residents believe that genetic engineering will make the quality of life much better (20 percent) or somewhat better (49 percent) for people like themselves. While people who approve of the genetic engineering of plants or animals are also more likely to think that genetic engineering will enhance the quality of life, 41 percent of those who disapprove of the genetic engineering of plants and 50 percent of those who disapprove of the genetic engineering of animals agree that genetic engineering will make the quality of life at

least somewhat better for people such as themselves. However, one-in-seven New Jersey residents was unsure what effect genetic engineering would have on the quality of their lives.

Almost three-out-of-four residents also "mildly" (37 percent) or "strongly" (36 percent) agree that genetic engineering will create jobs in New Jersey. However, believing that genetic engineering will create jobs does not necessarily lead people to approve of the technology. Of those who agree that the technology will create jobs in New Jersey, 19 percent disapprove of the genetic engineering of plants and 61 percent disapprove of the genetic engineering of animals.

About half of New Jersey's residents agree that the risks of genetic engineering have been greatly exaggerated. However, a third of the people who rated their understanding of science and technology as "very good" also disagreed that genetic engineering risks had been exaggerated. A similar proportion of the people who approve of the genetic engineering of plants or animals also believe the risks have not been exaggerated. Some people (15 percent) said that they were not sure about whether risks had been exaggerated or not.

Although most of the population in New Jersey is accepting of biotechnology research and some of its potential products, they are also clearly in favor of close government control over this research. Almost two-thirds of the population "strongly" agrees (44 percent) or mildly agrees (21 percent) that "the potential danger from genetic engineering is so great that strict regulations are necessary." Only 28 percent either mildly or strongly disagree with this statement. Most people (57 percent) also agree that "unjustified fears about genetic engineering have seriously blocked the development of beneficial foods," yet even 71 percent of these people also call for strict regulation.

Almost two-thirds of the population (63 percent) disagreed that "scientists in this country know what they are doing, so only moderate regulations on genetic engineering are probably necessary." Interestingly, scientists, engineers, and those who said that they belonged to scientific organizations, were no more likely to agree with this statement than non-scientists. Those in consumer and environmental groups were no more likely to disagree with this statement.

Concerns about possible risks to the environment are fairly polarized. **About 40 percent of the population believes that new genetically engineered plants or animals could pose a likely threat to the environment if they could reproduce.** However, a slightly greater proportion of people (46 percent) do not think such a threat is likely.

The survey showed that most of New Jersey's residents approved of a new genetic engineering laboratory or farm test-site no matter where it would be located. However, the closer a laboratory or farm test site was to the local community, the less support there was. Interestingly, there was little difference in the rates of approval or disapproval, whether the research facility was a relatively closed laboratory or relatively open field testing on a farm.

The survey found that the credibility of expert sources of information about

biotechnology varies significantly. **Scientists were seen as the most credible and companies that make genetically engineered products seen as the least credible sources of information about biotechnology.** Local farmers and environmental groups are also far more likely to be believed than state or federal government agencies. This apparent lack of belief in government agencies could prove problematic in future debates about the regulation of biotechnology.

Most of New Jersey's population believes that research into genetic engineering should be continued. Almost eight-out-of-ten people say that research into genetic engineering should be continued at the same level (44 percent) or increased (34 percent). Only 9 percent of the New Jersey public feels that genetic research should be stopped altogether, and another 9 percent believe it should be decreased.

Introduction

Biotechnology is expected to produce significant economic and environmental benefits as the result of the development of new varieties of plants and animals and improved agricultural productivity. Seen by many as a key technology for the 21st century and as an economic stimulus for the State of New Jersey and for the Nation, biotechnology has been the subject of intense scientific and public debate.

Proponents of biotechnology argue that the techniques are safe, following hundreds of years of producing hybrid plants and animals through cross-breeding and cross-pollination. They maintain that biotechnology's major innovation is that genes from very different organisms can be joined. For example, genes from a fish, such as flounder, may make sugar cane frost resistant or tomatoes stay ripe longer. Biotech methods can also produce new hybrids with specific characteristics in a much shorter time and with greater precision than with traditional crossbreeding. Many assert that biotechnology will lead to a second "green revolution," resulting in a greater variety of foods and other agricultural products that are more plentiful, are produced more efficiently, with less waste, with fewer pesticides, and with fewer negative effects on the environment.

Opponents of biotechnology suggest that not enough is known about the safety of these techniques or their products and that "playing God" is a dangerous game. They contend that gene splicing could convey lethal allergens to new foods, and that radioactive markers used to track the transfer of gene segments are potentially dangerous. Some also argue that splicing animal genes into plants violates "natural law" and could be offensive to vegetarians, and those with religious dietary restrictions. Many worry that accidental releases of genetically engineered organisms will create environmental mayhem. They call for increased governmental regulation, strict labeling of genetically engineered products, and for consumer boycotts of genetically engineered foods served in restaurants and sold in supermarkets.

Whatever their interpretations of the costs and benefits of biotechnology, both proponents and opponents agree that biotechnology has the potential to fundamentally change how food is produced in the future. Yet, while experts and activists continue to debate, genetic engineering techniques are already leading to agricultural products that may soon be on supermarket shelves. The U.S. Food and Drug Administration has ruled that it will not treat genetically engineered foods differently than other foods and will not require special testing or labeling, unless major modifications have been made or foreign genes have been inserted into plants. In addition, the U.S. Department of Agriculture has decided that it will no longer require permits, only notification, for most field trials of certain genetically engineered organisms, since the hundreds of field trials already conducted have not caused any environmental problems.

Despite the imminent introduction of genetically engineered agricultural products into the marketplace, little published research has detailed how American consumers actually feel about biotechnology or its products. To help remedy this, a telephone survey was commissioned by Rutgers University in May 1993 to assess public perceptions in New Jersey about both biotechnology and potential agricultural products created using biotechnology. The survey was conducted with a random sample of 604 New Jersey residents, under the direction of the Center

for Public Interest Polling of the Eagleton Institute of Politics at Rutgers University. The key objective of the survey was to examine the beliefs, attitudes and intentions of New Jersey residents toward agricultural biotechnology and its products. This background paper provides a brief summary of relevant prior studies and presents the data obtained from the present survey. The paper also briefly explores some policy implications of the survey's findings.

Previous surveys

While many "in-house" studies about consumer acceptance of particular biotech products were probably conducted by private concerns in the last decade, there have only been two major studies of public attitudes concerning biotechnology that were national in scope, and generally available to the academic community. The first was conducted by Louis Harris and Associates for the Office of Technology Assessment (OTA) of the U.S. Congress¹. For the survey, 1,273 adults were randomly selected from a probability sample based on a distribution of the adult population of the United States. Conducted by telephone in the Autumn of 1986, the survey focused on "public knowledge and opinion on science and technology issues in general, and genetic engineering and biotechnology in particular." While it did not focus on agricultural biotechnology per se, the survey did reveal important details about Americans' general attitudes toward biotechnology.

A second study, focusing more specifically on consumer attitudes about the use of agricultural biotechnology in the production of food was conducted by Dr. Thomas Hoban of North Carolina State University and Dr. Patricia Kendall of Colorado State University². In this study, 1228 adults were randomly selected from across the nation and interviewed by telephone during the Spring of 1992.

The results of both studies suggest that public awareness and understanding of biotechnology is relatively moderate but increasing. The OTA study found that a little more than one third (35 percent) had heard or read a fair amount about genetic engineering in 1986. In 1992, Hoban and Kendall found that a similar proportion (38 percent) had heard or read "some" or "alot" about biotechnology.

Both studies also suggest that while people report that they have heard or read little about biotechnology, the majority recognize some potential benefits and risks of the new technology and are generally supportive of it. In the OTA study, only about one-in-five Americans (19 percent) reported that they had heard about any potential dangers of genetically engineered products. Nonetheless, about half (52 percent) thought that these products could present a serious danger to people or to the environment. Six years later, Hoban and Kendall found that 65

¹Office of Technology Assessment (1987). New Directions in Biotechnology - Background Paper: Public Perceptions of Biotechnology. Washington DC: U.S. Government Printing Office.

²Hoban, T.J. & Kendall, P.A. (1992). Consumer Attitudes About the Use of Biotechnology in Agriculture and Food Production. Raleigh, NC: North Carolina State University.

percent could name at least one potential negative effect of biotechnology. Despite the recognition of the potential risks of biotechnology, the OTA study found that two-thirds of the public (66 percent) thinks that genetic engineering will make life better for all people. Answering a more specific question, over two-thirds of the respondents in the Hoban and Kendall study agreed that biotechnology would personally benefit people like themselves in the next five years and almost three quarters believe that biotechnology will positively affect food quality and nutrition. As a result, two-thirds of the respondents said that they supported the use of biotechnology in agriculture and food production.

While both studies report that most of the American people favor biotechnology, such support is certainly not universal. Both studies suggest that people who consider themselves religious had less favorable attitudes toward biotechnology. Support for biotechnology in both studies was associated with more formal education, more interest in science and technology, and more awareness of biotechnology. Those most supportive also tended to be younger, male, and in the Hoban and Kendall study, had higher incomes. Interestingly, Hoban and Kendall found no age-related differences in support for biotechnology nor associations between support and political philosophy or having a farm background.

Support for biotechnology also depends on the organisms involved. Both studies found that the public is much more supportive of the genetic engineering of plants and microorganisms than they are of animals. In addition, Hoban and Kendall found that transfers of genes within species was viewed as more acceptable than genetic transfers across species. Both studies also found significant moral objections to biotechnology. The OTA study reported that nearly one-fourth (24 percent) of the population who have heard about the use of genetic engineering to create hybrid plants and animals feel that it is morally wrong. Asked more specific questions, 24 percent of the respondents in the Hoban and Kendall study reported moral objections to using biotechnology to change plants and 53 percent reported moral objections to using biotechnology to change animals.

Both studies also point to a strong desire for adequate regulation of biotechnology. However, the studies also suggest a fairly low level of confidence in the government to assess the potential risks of biotechnology (OTA) or to effectively regulate biotechnology (Hoban and Kendall).

Public Perceptions of Agricultural Biotechnology: A Survey of New Jersey Residents

Questionnaire development

The questionnaire was initially developed in consultation with a team of Rutgers researchers representing a range of disciplines and expertise. These invaluable experts included: Dr. William Hallman, Project Leader, Department of Human Ecology, Dr. Laura Meagher, Center for Agricultural Molecular Biology; Ms. Caron Chess, Director of the Center for Environmental Communication; Dr. Mark Lapping, Dean, Edward J. Bloustein School of Planning and Public Policy; Dr. Daniel Rossi, Assistant Dean, Cook College; Dr. Donald Schaffner, Food Safety Specialist, Rutgers Cooperative Extension Service; Ms. Clare Liptak, Extension Specialist, Rutgers Cooperative Extension Service of Somerset County, Mr. Daniel Strombom, Extension Specialist, Rutgers Cooperative Extension Service of Cape May County. The questionnaire was designed to extend what is known about public perceptions of biotechnology. For comparison purposes, many questions measure concepts originally probed in the national surveys already described.

Considerable discussion occurred over what terminology should be used throughout the questionnaire to refer to the use of recombinant DNA. Technically, the term biotechnology is a broad one, encompassing not only the use of recombinant DNA, but other techniques as well. These include monoclonal antibody technology and a variety of cell and tissue culture technologies. The term "genetic engineering", while sometimes misused, generally refers to the alteration of genetic material of living organisms, using recombinant DNA techniques. While somewhat more specific, the term genetic engineering has some negative images attached to it, some of which are catalogued in the results section of this survey. While the term biotechnology is less specific, and probably has fewer negative images attached to it, the research team decided that it was probably a less familiar term to non-scientists, a focus group composed of college students confirmed this. The phrase genetic engineering has been used in mass circulation publications since the 1970's. Popular newspapers and magazines continue to use the phrase, as do most of the opponents of biotechnology. Finally, the term genetic engineering was chosen after subjects in the focus group complained that using the term biotechnology seemed to them an effort to trick respondents into answering questions about genetic engineering without calling it that. Thus, to be completely aboveboard, the term genetic engineering was used throughout the survey, despite its negative connotations.

Four drafts of the telephone questionnaire, which was expected to last approximately twenty minutes, were circulated among the Rutgers experts. A fifth draft was prepared in consultation with Ms. Janice Ballou, Director of the Center for Public Interest Polling of the Eagleton Institute of Politics at Rutgers University. This draft was pretested using a team of professional telephone interviewers. It was modified based on the results of this pretest, debriefing of the telephone interviewers, and taped recordings of pretest interviews. The sixth and final draft of the survey instrument is included at the end of this report. The final version of the survey instrument was programmed into a CATI (Computer Assisted Telephone Interviews) system.

Sample selection and weighting

A random proportional probability sample was used to select the 604 New Jersey residents eighteen years of age and older who were contacted to participate in this study. The sample was designed to ensure that each of the state's twenty-one counties was proportionally represented and that an equal number of men and women were interviewed. The three digit exchanges were used to match telephone numbers with geographic areas. The remaining four digits were randomly selected. This procedure insures that those with unlisted or new telephone numbers are included in the sample. More information about the sample selection is included at the end of this report. Each working telephone number was called a minimum of three times, at different times of the week, to reach people who were infrequently at home.

Ideally, those who are interviewed in a survey have the same characteristics as the population they represent. Unfortunately, many samples of respondents under-represent groups that are more difficult to contact or to interview, such as the elderly or those with less than a high school education. To compensate for this under-representation, the statistical technique known as weighting is used. The weighting procedure compares the number of respondents in the sample that fall into specific categories of age and education with the number of people one would expect to interview in those categories, based on census figures for the State of New Jersey. When there is a significant difference between the number of interviews expected and the number obtained, the sample is weighted so that it more accurately reflects the characteristics of the population of the State. For example, if census figures show that 39 percent of New Jerseyans, aged eighteen and older have a high school education, and only 32 percent of those interviewed have high school educations, each of these respondents would be counted as 1.21 persons to adjust for the difference.

The percentages reported in this survey are estimates of what the distribution of responses would be if the entire population of the State of New Jersey had been interviewed. "Sampling Error" describes the probable difference between interviewing everyone in a particular population and a sample drawn from that population. The sampling error associated with a statewide sample of 600 people is approximately ± 4.0 percent at a 95 percent confidence interval. Thus, if 35 percent of those interviewed agree with a particular statement, the number of people in the State of New Jersey who would agree is between 31 percent and 39 percent (35 ± 4.0), ninety-five out of one hundred times.

Readers should note that sampling error increases as the sample size is reduced. For example, if percentages are based on a sample size of 300 people, the sampling error is ± 8.0 percent. This fact should be kept in mind when comparing the responses of different groups within the sample, such as the responses of men compared to those of women. It should also be noted that estimates of sampling error do not consider other sources of error intrinsic to studies of public opinion.

Data collection

A total of 604 CATI interviews were conducted with a random probability sample of New Jersey residents eighteen years old and older. Each interview lasted an average of 20.5 minutes. The interviews were conducted between June 7 and 20, 1993 by experienced professional

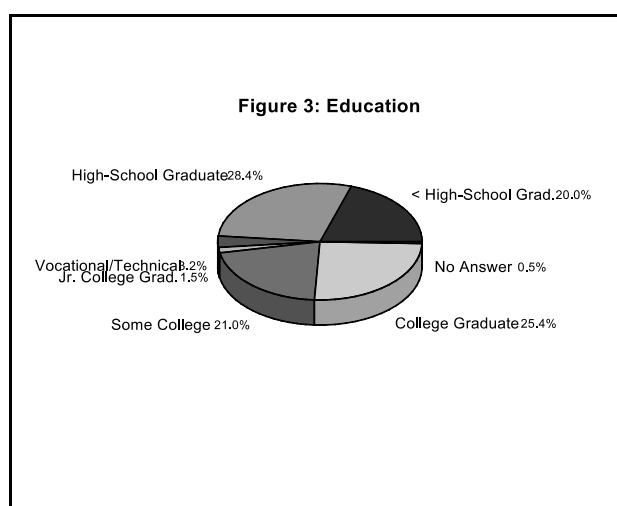
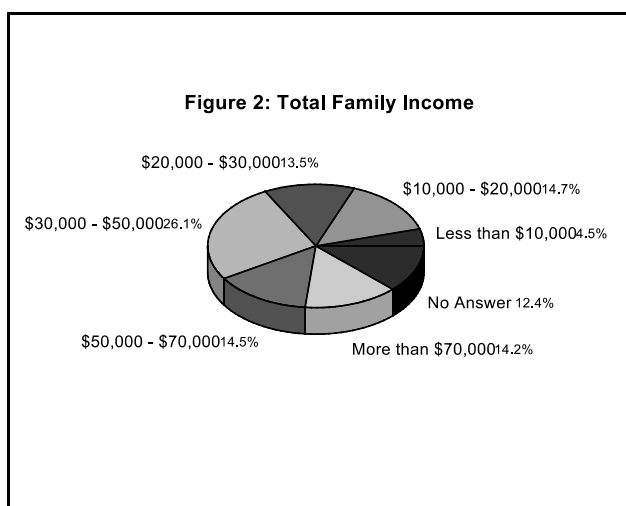
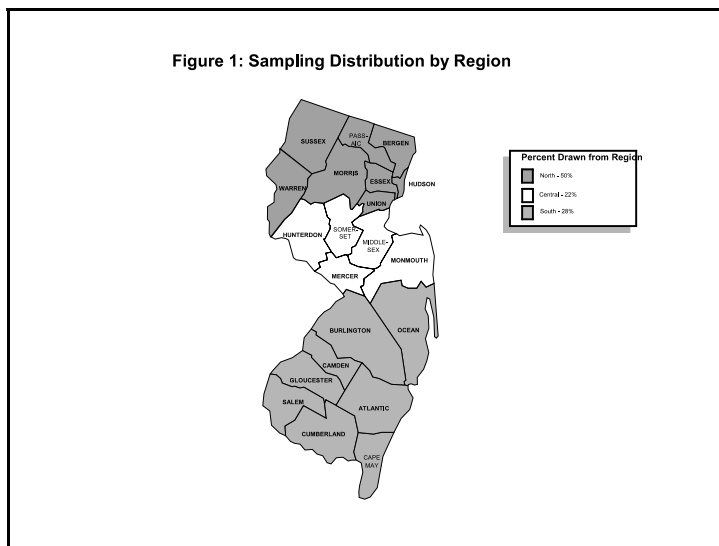
interviewers from the market research firm, Schulman, Ronca, and Bucalavalas. The interviewers were trained and monitored by the research staff of the Center for Public Interest Polling, of the Eagleton Institute of Politics. Of those contacted and qualified to complete the survey, 75 percent responded.

Sample demographics

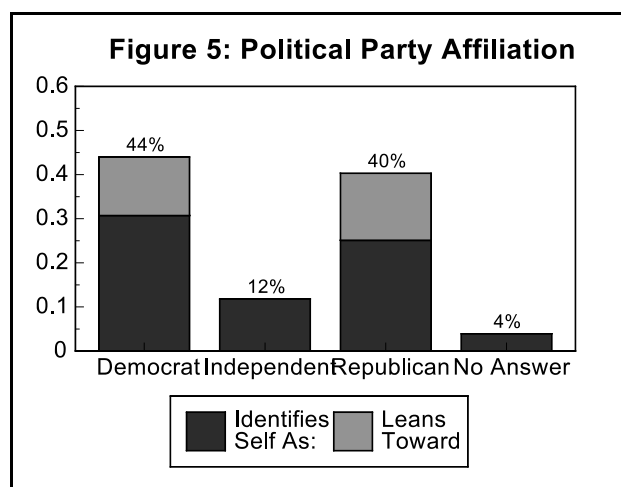
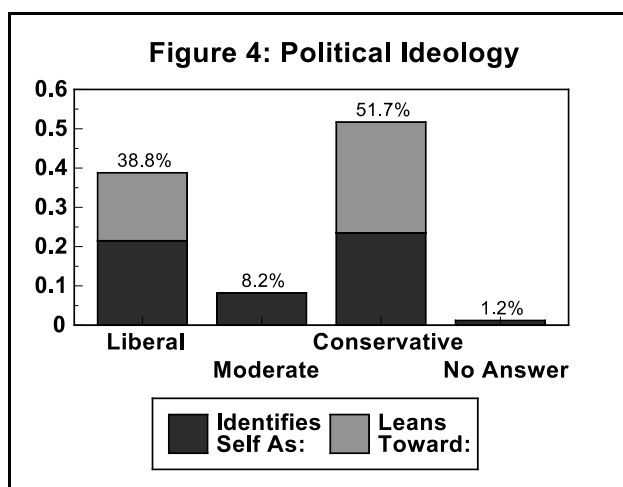
By design, half the respondents to the survey were male and half were female. Also by design, to correspond with the known population densities within the state, 50 percent of those interviewed were from Northern New Jersey, 22 percent were drawn from Central New Jersey and 28 percent were from the southern part of the state (See Figure 1).

Respondents' ages ranged from eighteen to ninety-two, with a median age of forty-three. Thirty-five percent had children under the age of twenty-one. Seventeen percent had children under the age of six.

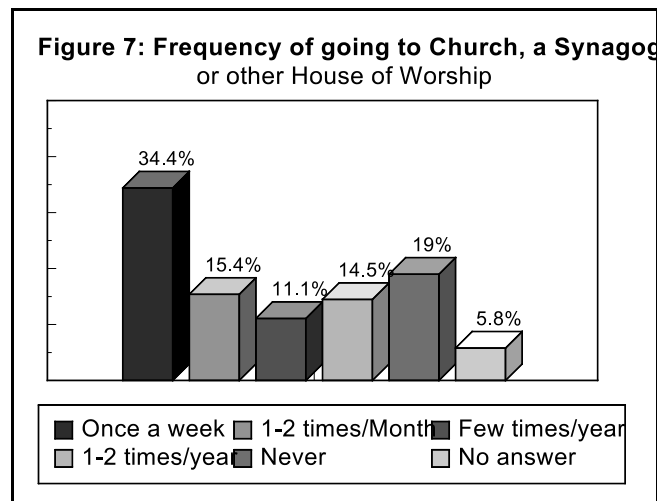
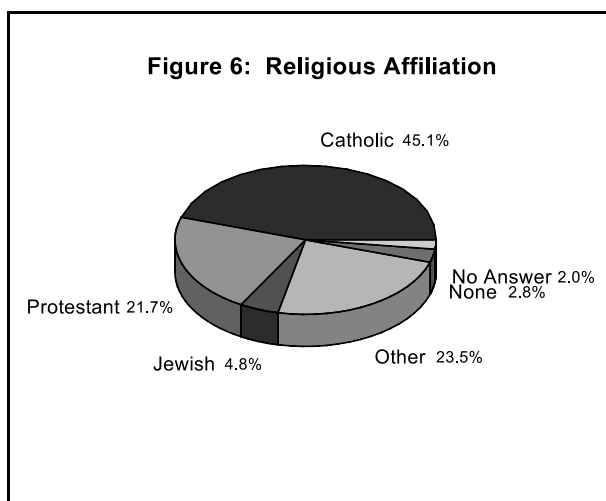
Median income was between \$30,000 and \$50,000 (See Figure 2). A little more than one quarter of those interviewed had graduated from college. About one-in-five had not graduated from high school. (See Figure 3).



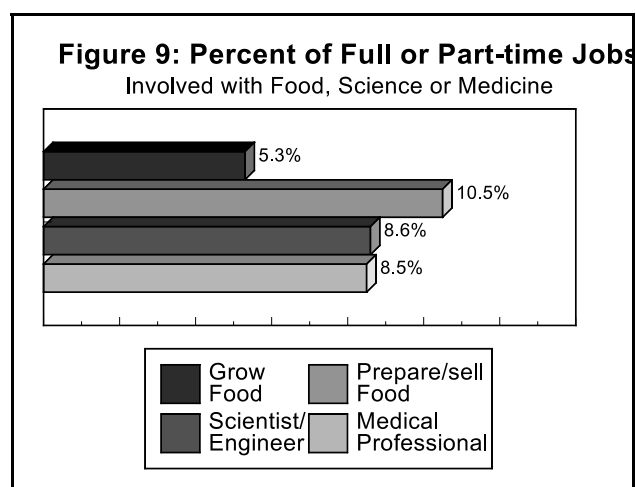
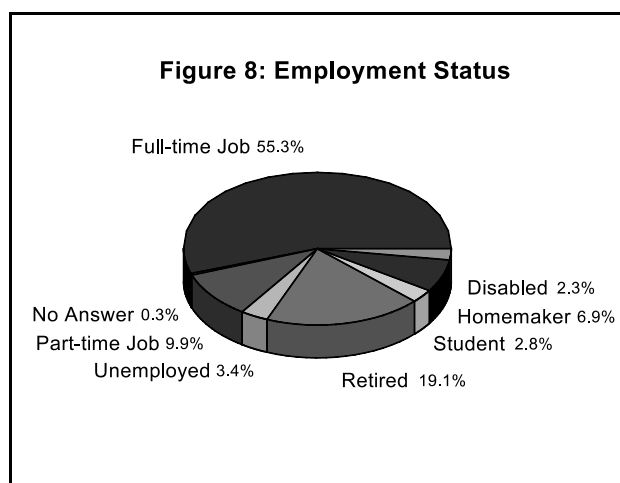
About half (52 percent) said that they tend to be politically conservative, about four-in-ten (39 percent) politically liberal, and about 8 percent said that their political ideology is somewhere in between (See Figure 4). Whatever their political ideology, nearly one third (31 percent) of the respondents said that they are Democrats and an additional 13 percent said that they lean toward the Democratic Party. One quarter of the respondents (25 percent) said that they are Republicans and an additional 15 percent said that they lean toward the Republican Party. About 12 percent said that they are Independents (See Figure 5).



Forty-five percent of the respondents said that they considered themselves Catholics, 22 percent consider themselves Protestants, 5 percent consider themselves Jewish. Nearly one quarter (24 percent) consider themselves to have a religious affiliation other than Catholic, Protestant, or Jewish. The remaining 5 percent say that they have no religious affiliation, don't know or refused to answer (See Figure 6). No matter their religious affiliation, more than half the respondents (52 percent) say that they attend a church, synagogue or other house of worship at least once or twice a month (See Figure 7).



Fifty-five percent of those interviewed said that they are employed full-time. An additional 10 percent said that they have part-time jobs. The remaining respondents were either unemployed, retired, students, homemakers, disabled or a member of the military (See Figure 8). Of those who said that they were employed either full or part-time, 9 percent said that their job involved growing food and 11 percent said that they prepared or sold food. Of those working, 9 percent said that they were scientists or engineers and 9 percent said that they were medical professionals. (See Figure 9). Of the total sample, 9 percent said that they belonged to an environmental group, 6 percent said that they belonged to a scientific organization, and 6 percent reported belonging to a consumer group.



Understanding of science and technology

One quarter of New Jersey's citizens (25 percent) rate their understanding of science and technology as very good, and over half (55 percent) say their understanding is at least adequate. Men, younger people and better educated people rated their understanding highest (see Table 1). New Jersey's residents also rate their understanding of science and technology much higher than

respondents in national surveys. For example, in a national survey carried out by the Office of Technology Assessment (OTA) in 1986, only about one-in-six Americans (16 percent) rated their basic understanding of science and technology as very good.

Table 1: Understanding of science and technology

Question (2):	Would you rate your own basic understanding of science and technology as very good, adequate or poor?				
		Very good	Adequate	Poor	Not sure
	604 ^a	25%	55%	20%	<1%
Sex					
Male	302	30	57	12	<1
Female	302	19	53	28	1
Age					
18-24	76	29	62	10	-
25-29	61	31	55	14	-
30-39	108	26	52	20	2
40-49	113	24	60	15	<1
50-59	89	20	54	25	1
60+	144	21	51	28	-
Education					
< High school	42	10	63	25	2
High school grad	169	20	52	28	-
Some college	133	35	50	15	<1
College grad	257	33	56	11	<1

^aPercentages are presented as weighted sample estimates. The unweighted sample base is presented in the first column so that sampling variances for these estimates can be calculated.

Awareness of genetic engineering

The survey found that awareness of biotechnology among New Jersey's residents is slightly higher than that found in recent national surveys. Nearly half the New Jersey population (48 percent) had heard or read some or a great deal about genetic engineering. Earlier National surveys found that only about four-out-of-ten Americans (38 percent) were equally aware of biotechnology (OTA, 1987; Hoban & Kendall, 1992). It is unclear whether the greater awareness recorded in this survey represents geographical or temporal factors. That is, people in New Jersey may be more aware than other U.S. citizens, or, awareness may be greater across the nation due to the fact that biotechnology has received a great deal of news coverage since 1992.

In New Jersey, awareness was greatest among men, people with more education and those who think they have a very good understanding of science and technology (see Table 2). An analysis of variance found that, not surprisingly, respondents who work as scientists or engineers, or who belong to a scientific group or organization, were more likely to have heard or read about genetic engineering. Similarly, those who said that they belonged to an environmental or consumer group or organization were more likely to have heard of genetic engineering. However, medical professionals, and those whose jobs involve growing food were no more likely to have heard of genetic engineering than other respondents. Those whose jobs involve preparing or selling food were less likely to have heard of genetic engineering than other respondents.

Table 2: Awareness of genetic engineering

Question (12a):		Genetic engineering involves new methods that make it possible for scientists to create new plants and animals by taking parts of the genes of one plant or animal and inserting them into the cells of another plant or animal. This is sometimes called gene splicing or biotechnology. How much have you heard or read about these methods - a great deal, some, not much, or nothing at all?					
		Great deal	Some	Not much at all	Nothing	Not Sure	
		604 ^a	9%	39%	33%	19%	<1%
Sex							
Male	302	13	46	28	13	<1	
Female	302	4	33	38	25	<1	
Education							
< High school	42	3	22	42	34	-	
High school grad	69	4	37	36	22	1	
Some college	133	10	45	34	11	-	
College grad	257	18	51	22	9	-	
Understanding of science & Technology							
Very good	167	20	45	24	10	<1	
Adequate	327	5	39	36	20	<1	
Poor	106	4	32	35	29		
Not sure	3	-	-	86	14		
Refused	1	100	-	-	-		

^a Percentages are presented as weighted sample estimates. The unweighted sample base is presented in the first column so that sampling variances for these estimates can be calculated.

Images of genetic engineering

To get a sense of the kinds of mental images they have about biotechnology, the respondents were asked about the first thoughts or images that come to mind when they think about genetic engineering (see Figure 10). Interestingly, more than one-in-four people (26 percent) could not say what their first thought or image was when asked to think about genetic engineering. This was not entirely due to unfamiliarity with the subject. Many (29 percent) of those who said that they had heard some or a great deal about genetic engineering could not say what their first thought or image was related to the technology.

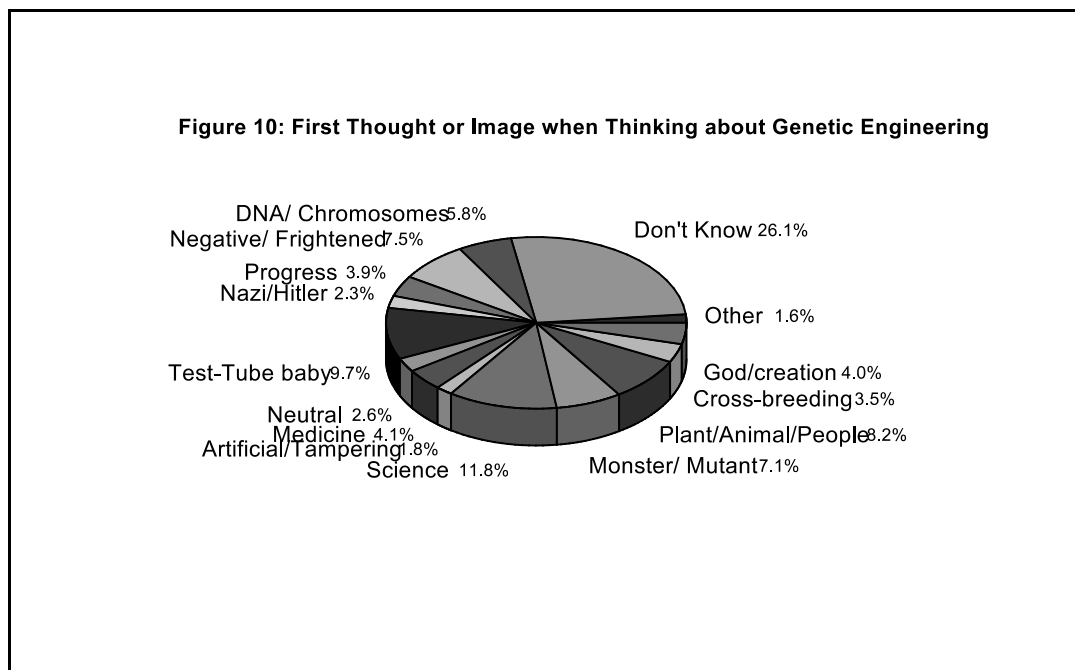
Aside from the "don't know" category, the most popular response (12 percent) was related to science, scientific equipment or high technology. This was followed by images of test-tube babies, embryos, cloning, and the book Brave New World (10 percent).

The next most frequent response was not an image but an emotional reaction. Seven and one-half percent responded with negative words like, "frightened" or "bad" or "don't approve." An additional 2 percent used more specific negative words and images such as: "mutilation," "escaping virus," "cancer," "disease," "Nazi/Hitler," and, "mad scientist." Moreover, the images of mutants, monsters, and extra-large plants or animals were the first thoughts of 7 percent of those interviewed. Another 2 percent said things like: "artificial," "tampering," or, "experimental." In total, the first reaction of nearly one-in-five people was essentially negative.

Not all of the public's first thoughts or images concerning genetic engineering were negative however. Besides images of science, the first thought for 6 percent of the public was

DNA, chromosomes or molecular biology. Other essentially neutral thoughts concerned crossbreeding (4 percent), God, creation, and life (4 percent), and general thoughts about plants (4 percent), animals (3 percent), people (2 percent), and other images (3 percent).

Some of the public's first thoughts about genetic engineering were also quite positive. Medical advances were mentioned by 4 percent. Ideas of "progress," "safe," and, "natural" were the responses of an additional 4 percent of the public.



Knowledge about food production

The survey found that most New Jersey residents (91 percent) felt that they had an adequate or very good understanding of how food is grown and produced. However, much of the public was unfamiliar with traditional methods for producing hybrid plants and animals. While over half the population (54 percent) acknowledged that they had heard of cross-fertilization or cross-breeding, only 28 percent said they had eaten a fruit or vegetable produced by this method. This is quite surprising since nearly all fruits and vegetables commercially available are the products of these traditional hybridization techniques. What is even more surprising is that 17 percent of the population believes that they have eaten a fruit or vegetable produced by genetic engineering, though no such product is yet available to consumers. Interestingly, people who say they have heard or read a "great deal" or "some" about genetic engineering were more likely to say they have eaten a genetically engineered product than those who have read or heard "not much" or "nothing at all."

Morality and approval of traditional cross-breeding and biotechnology

Most of New Jersey's citizens (59 percent) approve of producing hybrid plants by using traditional cross-fertilization techniques. Not surprisingly, those who said that they had heard of the techniques were most likely to approve. However, one-in-five people (20 percent) believes

that it is morally wrong to produce new plants in this way. Producing hybrid animals through cross-breeding is viewed even more negatively. Most people (62 percent) in New Jersey disapprove of producing hybrid animals using this method and half (50 percent) believe that it is morally wrong. While the number of people who say they disapprove of traditional crossbreeding techniques is at first a little surprising, similar numbers of people were found to disapprove of these techniques in national surveys. In the 1987 OTA report, 26 percent of those who had heard of traditional cross-breeding disapproved of it. Similarly, Hoban and Kendall (1992) found that 20 percent of their respondents disapproved of cross-breeding plants and 44 percent disapproved of cross-breeding animals.

Thinking that the relatively low number of people who said that they had heard of, and approved of traditional crossbreeding was the result of the definition of crossbreeding given in the surveys, several new definitions were pretested. Crossbreeding is a basic scientific concept now taught in the sixth grade, and hybrid plants are advertised in seed catalogs and are staples in the garden. Yet, several variations in the definition presented in the survey failed to evoke any more of a glint of recognition than that presented in the survey's final form. Whether one approves or disapproves of biotechnology, the fact that half the population is unaware of current methods to improve plants and animals must be considered a serious deficiency in public scientific literacy.

Differences in the acceptability of hybridizing plants versus animals using traditional methods of crossbreeding are also reflected in the views that people have about hybridization using biotechnology. A majority (61 percent) of New Jersey residents approve of using genetic engineering techniques to produce new plants but less than one third (28 percent) approves of using these techniques to produce new animals. While people who approve of producing genetically engineered animals are also likely to approve of producing genetically engineered plants, the reverse is not true. Almost half (49 percent) of the people who approve of the use of genetic engineering for plants do not approve of using it for animals.

Approval of using genetic engineering on either plants or animals increases with education, awareness of genetic engineering techniques, and understanding of science and technology (see Table 3a and 3b). Interestingly, Republicans are more likely to support genetic engineering of plants than Democrats or Independents while Independents give more support for genetic engineering of animals than either Republicans or Democrats. People who consider themselves to be Jewish are more supportive of genetic engineering than Catholics, Protestants, or those reporting other religious affiliations (see Table 3a and 3b). People with children under age five were also less likely to approve of the genetic engineering of plants, but no more likely to disapprove of the genetic engineering of animals.

Scientists, engineers, medical professionals, and those who said that they belonged to an environmental or consumer group were statistically no more or less likely to approve of the genetic engineering of either plants or animals. However, those who said that they belonged to scientific groups or organizations were more likely to approve of the genetic engineering of plants but not animals. Those whose jobs involve growing food were more likely to approve of the genetic engineering of animals, but no more likely to approve or disapprove of the genetic

engineering of plants. The reverse was true for those whose job involves preparing or selling food. They were more likely to disapprove of the genetic engineering of plants, but no more likely to approve or disapprove of the genetic engineering of animals.

People's views concerning the hybridization of plants and animals were relatively consistent despite the techniques used to bring it about. A comparison of the approval ratings for the two technologies shows a strong degree of internal agreement. People who approve of traditional cross-breeding methods for producing hybrid plants are also likely to approve of producing hybrid plants through genetic engineering. The same is true for producing hybrid animals. Objections to producing hybrid organisms appear to lie more with the organisms involved (manipulation of plants or animals) rather than the process involved.

Table 3a: Support for genetic engineering techniques of plants

Question (16a): In general, do you approve or disapprove of creating hybrid plants using genetic engineering?

	Approve	Disapprove	Not sure	Refused	
	604 ^a	61%	31%	7%	<1%
Sex					
Male	302	66	31	2	<1
Female	302	57	31	12	<1
Education					
< High school	42	34	58	7	-
High school grad	169	54	35	10	<1
Some college	133	78	18	4	-
College grad	257	77	17	5	1
Party affiliation					
Democrat	256	53	39	8	<1
Independent	68	60	29	9	<1
Republican	262	71	23	6	<1
Don't know	9	58	42	-	-
Refused	9	71	29	-	-
Religion					
Catholic	270	62	31	7	<1
Protestant	142	69	22	9	<1
Jewish	42	85	11	5	-
Other	122	53	42	6	-
None	15	37	59	-	4
Don't know/refused	13	52	36	13	-
Heard of genetic engineering					
Great deal	69	81	19	-	-
Some	260	74	20	5	1
Not much	180	52	39	9	-
Nothing at all	92	45	43	11	<1
Not sure	3	-	100	-	-
Understanding of science & Technology					
Very good	167	68	27	5	<1
Adequate	327	63	32	5	<1
Poor	106	52	36	12	-
Not sure	3	-	-	86	14
Refused	1	100	-	-	-
Occupation					
Food Grower	19	70	30	-	-
Food Preparer/Seller	35	51	48	1	-
Scientist/Engineer	46	77	21	2	-
Medical Professional	44	72	27	1	-
Belongs to:					
Environmental group	62	62	32	4	1
Scientific organization	51	85	11	5	-
Consumer group	41	59	39	2	-

^a

Percentages are presented as weighted sample estimates. The unweighted sample base is presented in the first column so that sampling variances for these estimates can be calculated.

Table 3b: Support for genetic engineering techniques of animals

Question (16c): In general, do you approve or disapprove of creating hybrid animals using genetic engineering?

	Approve	Disapprove	Not sure	Refused	
	604 ^a	28%	65%	7%	<1%
Sex					
Male	302	37	56	6	1
Female	302	19	73	8	<1
Education					
< High school	42	15	83	3	-
High school grad	169	20	68	10	<1
Some college	133	38	56	5	-
College grad	257	39	52	7	2
Party affiliation					
Democrat	256	22	74	4	<1
Independent	68	41	51	6	2
Republican	262	33	57	10	1
Don't know	9	11	73	15	-
Refused	9	6	81	13	-
Religion					
Catholic	270	22	72	5	<1
Protestant	142	34	57	8	1
Jewish	42	53	32	11	5
Other	122	30	63	7	<1
None	15	14	73	13	-
Don't know/refused	13	26	57	17	-
Heard of genetic engineering					
Great deal	69	43	44	13	-
Some	260	36	57	6	1
Not much	180	24	71	5	<1
Nothing at all	92	11	78	9	1
Not sure	3	38	62	-	-
Understanding of science & Technology					
Very good	167	34	57	9	<1
Adequate	327	27	66	7	<1
Poor	106	24	71	4	<1
Not sure	3	-	86	-	14
Refused	1	100	-	-	-
Occupation					
Food Grower	19	57	39	4	-
Food Preparer/Seller	35	32	68	-	-
Scientist/Engineer	46	37	58	5	-
Medical Professional	44	31	63	5	2
Belongs to:					
Environmental group	62	32	65	3	-
Scientific organization	51	36	58	6	-
Consumer group	41	31	66	4	-

^a Percentages are presented as weighted sample estimates. The unweighted sample base is presented in the first column so that sampling variances for these estimates can be calculated.

Turning the clock back?

Most people in New Jersey do not want to turn the clock back on biotechnology. Only 19 percent of those surveyed agreed either strongly (12 percent) or mildly (7 percent) that it would be better if we did not know how to do genetic engineering at all. Moreover, half the population strongly disagreed with this view. This is in contrast to the results of the 1987 OTA national survey where a third (33 percent) of the public reported that they would prefer to turn the clock back on genetic engineering and only 31 percent of the population strongly disagreed with this statement.

A sizable majority (58 percent) of the public in New Jersey also disagreed with the statement, "we have no business meddling with nature." Yet, opinion was polarized on this issue with 27 percent strongly agreeing that we have no business meddling with nature and 31 percent strongly disagreeing with this statement.

People most likely to disagree with both statements were men, those with more education, those who consider themselves to be Jewish, Protestants, or Republicans, those who have heard more about genetic engineering, people who think they have a good understanding of science and technology, and people who approve of genetic engineering to produce hybrid plants or animals (see Tables 4a and 4b). While these relationships are interesting, it should be noted that feeling that we have no business meddling with nature and that it would be better if we did not know how to do genetic engineering is not necessarily a function of a lack of understanding of science, technology or biotechnology. People who had heard or read a great deal about genetic engineering were no less likely than others to agree that "it would be better if we could not do genetic engineering." Similarly, 28 percent of people who said they had a very good understanding of science and technology strongly agreed that we have "no business meddling with nature."

Only about 15 percent of the public agree that we have no business meddling with nature and that it would be better if we did not know about genetic engineering (Table 5). Over half the people in New Jersey (56 percent) disagree with both statements. Interestingly, almost one-in-five people agrees that "we have no business meddling with nature" but disagreed that "it would be better if we did not know how to do genetic engineering at all" (see Table 5).

Table 4a: It would be better if we didn't know about genetic engineering

Question (26d):		It would be better if we did not know how to do genetic engineering at all. Do you agree or disagree?					
		Strongly agree	Mildly agree	Mildly disagree	Strongly disagree	Not Sure	Refused
	604 ^a	12%	7%	27%	50%	3%	<1
Sex							
Male	302	14	6	20	58	3	<1
Female	302	11	8	34	43	4	<1
Education							
< High school	42	27	12	28	28	5	-
High school grad	169	15	7	31	42	4	1
Some college	133	3	7	23	65	2	-
College grad	257	6	2	25	66	1	<1
Party affiliation							
Democrat	256	16	7	29	47	<1	<1
Independent	68	14	9	17	48	11	1
Republican	262	8	6	29	55	2	<1
Don't know	9	10	-	19	63	8	-
Refused	9	19	20	7	25	30	-
Religion							
Catholic	270	15	7	25	49	4	<1
Protestant	142	8	5	31	53	3	-
Jewish	42	5	3	21	69	2	-
Other	122	14	7	30	47	2	1
None	15	8	11	31	51	-	-
Don't know/refused	13	12	17	7	43	21	-
Heard of genetic engineering							
Great deal	69	12	7	9	70	1	2
Some	260	5	4	26	62	3	<1
Not much	180	17	5	36	41	2	-
Nothing at all	92	18	15	24	35	8	<1
Not sure	3	35	27	-	38	-	-
Understanding of science & Technology							
Very good	167	13	6	19	58	3	-
Adequate	327	11	6	29	50	4	<1
Poor	106	15	9	32	41	2	<1
Not sure	3	-	-	18	82	-	-
Refused	1	-	-	-	100	-	-
Approve of genetic engineering of plants							
Approve	406	4	6	23	64	3	<1
Disapprove	154	30	11	30	27	2	<1
Not sure	40	5	2	48	28	15	2
Refused	4	-	-	19	81	-	-
Approve of genetic engineering of animals							
Approve	186	2	4	15	76	3	-
Disapprove	366	17	8	32	38	3	<1
Not sure	45	7	4	23	59	6	1
Refused	7	-	-	36	64	-	-

^a Percentages are presented as weighted sample estimates. The unweighted sample base is presented in the first column so that sampling variances for these estimates can be calculated.

Table 4b: We have no business meddling with nature

Question (26g):	We have no business meddling with nature. Do you agree or disagree?					
	Strongly agree	Mildly agree	Mildly disagree	Strongly disagree	Not Sure	Refused
	604 ^a	27%	13%	28%	31%	2%
Sex						
Male	302	26	9	26	37	1
Female	302	28	17	29	24	2
Education						
< High school	42	48	12	16	25	-
High school grad	169	33	17	23	24	3
Some college	133	14	15	35	35	2
College grad	257	14	8	37	41	<1
Party affiliation						
Democrat	256	31	12	28	29	1
Independent	68	31	14	20	35	-
Republican	262	21	14	30	33	2
Don't know	9	21	31	12	29	8
Refused	9	48	-	36	16	-
Religion						
Catholic	270	28	17	28	26	2
Protestant	142	23	9	31	37	-
Jewish	42	9	5	35	51	-
Other	122	33	13	21	30	3
None	15	17	11	28	44	-
Don't know/refused	13	33	-	36	23	9
Heard of genetic engineering						
Great deal	69	13	3	34	50	-
Some	260	17	14	30	40	-
Not much	180	33	14	29	22	2
Nothing at all	92	43	14	20	19	4
Not sure	3	65	35	-	-	-
Understanding of science & Technology						
Very good	167	28	9	26	36	1
Adequate	327	26	14	28	30	2
Poor	106	29	16	29	25	2
Not sure	3	18	-	-	82	-
Refused	1	-	-	-	100	-
Approve of genetic engineering of plants						
Approve	406	12	12	35	40	1
Disapprove	154	56	14	15	13	1
Not sure	40	32	19	24	20	6
Refused	4	-	19	-	81	-
Approve of genetic engineering of animals						
Approve	186	11	5	27	57	-
Disapprove	366	36	17	26	19	2
Not sure	45	7	7	42	35	9
Refused	7	-	16	20	64	-

^a Percentages are presented as weighted sample estimates. The unweighted sample base is presented in the first column so that sampling variances for these estimates can be calculated.

Table 5: Comparison of opinions about genetic engineering and meddling with nature

Question (26d): It would be better if we did not know how to do genetic engineering at all		
	Agree	Disagree
Question (26g): We have no business meddling with nature		
Agree	15	24
Disagree	5	56

Based on weighted data

Acceptance of genetically engineered products

The survey also examined whether public acceptance of the application of biotechnology differs with regard to specific products. Twelve potential uses of genetic engineering were presented to survey participants in random order. In each case respondents were asked: Based on what you know, do you approve or disapprove of scientists using genetic engineering to create (ITEM)?

As indicated in Table 6 there was majority support for ten of the twelve items. Support was given for products related to:

- human health and welfare (items b, e, f, i, j),
- saving money or time (items c, d, k), or
- the environment (items a, l).

The strongest support was given to items regarding human health. For example, most of the population of New Jersey strongly (81 percent) or mildly (12 percent) approves of creating new drugs to cure human diseases. A similar proportion of the population supports the creation of hormones like insulin that help people with diabetes. There is also strong support (68 percent) for genetically engineering "more nutritious grain that could feed people in poor countries." New Jersey's residents would also welcome genetically engineered bacteria that can help clean up oil spills.

However, most of the population in New Jersey is against developing genetically engineered hormones that can help cows produce more milk or beef. In fact, about four out of every ten New Jersey residents strongly oppose the development of such hormones using genetic engineering. This may indicate concern about the effect of these hormones on human health or the disapproval of any manipulation of animals. The population's ambivalence about genetically engineering a hormone to produce beef with less cholesterol (item j) may reflect both concerns about health (less cholesterol in one's diet) and concerns about the perceived risks to food safety associated with injecting cows with a hormone. There also was a polarization of views (as indicated in Table 6) with people either strongly approving or disapproving of a particular product. Acceptance of different biotechnology products appears to be influenced both by considerations of personal benefits or risks (especially food safety) and humanitarian goals.

Acceptance of genetically engineered products appears to be influenced more by

the characteristics of the products themselves than the perceived morality of techniques used to create them. For example, 62 percent of people who strongly disapprove of producing bacteria to clean up oil spills do not think it is morally wrong to genetically engineer plants. On the other hand, well over a third of the people (42 percent) who strongly or mildly approve of producing a hormone to help people with diabetes also believe it is morally wrong to genetically engineer plants. There are similar results for people's approval of genetically engineered products such as: a new grass that does not need to be mown so often, new drugs to cure disease, and more nutritious grain to feed people in poor countries. Parents of children under the age of five were no less likely to approve of any of the genetically engineered products than their counterparts. Clearly, people's views about genetic engineering may change when a specific product is described. People appear to be far more focused on the characteristics of the products than the process used to create them. As such, people may be willing to overlook their objections to genetic engineering if its products produce specific benefits.

Table 6: Opinions about the applications of genetic engineering

Question (20): Based on what you know, do you approve or disapprove of scientists using genetic engineering to create (ITEM)

ITEM	Strongly approve	Mildly approve	Mildly disapprove	Strongly disapprove	Not sure /refused
(e) New drug to cure human disease	81%	12%	2%	3%	2%
(f) Hormone like insulin to help people with diabetes	78	15	2	3	2
(i) More nutritious grain to feed people in poor countries	68	18	5	8	1
(a) Bacteria to clean up oil spills	62	21	5	7	5
(k) New grass that doesn't need to be mown so often	50	28	6	13	3
(d) Fruits and vegetables that are less expensive	47	26	11	13	3
(l) Fruits and vegetables that have own chemical defenses against pests	40	25	11	20	4
(b) Better tasting fruits and vegetables	38	29	14	18	1
(c) Fruits and vegetables that last longer on supermarket shelf	34	23	13	28	2
(j) Hormones that enable cows to produce beef with less cholesterol	32	25	11	29	3
(g) Hormones that enable cows to give more milk	21	19	17	40	3
(h) Hormones that enable cows to give more beef	17	22	19	40	2

Based on weighted data

Consumer attitudes

Consumer profile

Although marital status was not recorded, so it is not possible to say how many respondents are currently married, 70 percent of the women interviewed said that they did most of the food shopping for their families. Thirty-six percent of the men interviewed said that they did most of the shopping for their families. Interestingly, about 12 percent of the men interviewed said that the job of food shopping was equally split between their mate and themselves, while only 3 percent of the women interviewed said that the job was equally divided.

Thirty-five percent of those interviewed said that they had children under the age of twenty-one. Seventeen percent said that they had at least one child under the age of five. One-in-five (20 percent) of the respondents said that someone in their family had a food allergy.

Nearly 6 percent of the population reports belonging to a consumer organization. Those most likely to belong to such organizations were both better educated and in either the 25-29 or the 50-59 age ranges. Similarly, about 9 percent report belonging to an environmental organization. Contrary to popular stereotypes, those who reported belonging to these organizations were more likely to be in their 40's and 50's rather than in their 20's and 30's.

About one-in-four of New Jersey's residents (24 percent) say they sometimes shop in "natural" or "organic" food stores, and about half (49 percent) of the population reports having seen fresh fruits or vegetables labeled "organic" or "pesticide free" in the places where they normally shop. Not surprisingly, most of the population in New Jersey feels that it is very important (37 percent) or somewhat important (37 percent) that the fruits and vegetables they eat are grown organically. However, nearly 67 percent say that most, if not all of the produce in the stores where they normally shop has been treated with pesticides at some point. Only two and one-half percent said that none of the produce in the stores where they shop was treated with pesticides.

Organic maybe, but not natural.

Given the apparent interest in organically grown fruits and vegetables, responses to statements about whether genetically engineered food could be considered "organic" or "natural" are particularly interesting. Most of the population (85 percent) agrees that "growing genetically engineered plants that contain higher levels of naturally occurring chemicals that protect against pests and disease is better than using pesticides." However, while a majority (55 percent) of those surveyed agreed that "food that is produced from genetically engineered plants that contain higher levels of naturally occurring chemicals that protect against pests and disease should be considered *organic*," a similar proportion (54 percent) agreed that food produced from such plants should not be sold in 'natural' food stores. More than nine out of ten (91 percent) of those who agree that such genetically engineered food should be considered organic also agree that this food should not be sold in natural food stores. This suggests that while most people see potential "organic" benefits from the genetic engineering of fruits and vegetables, they clearly do not see such products as "natural." Further research may identify which attribute, "natural" or "organic" is most important to consumers.

There is an interesting relationship between the importance of organic produce to people and whether they think genetically engineered plants that resist pests are better than plants exposed to pesticides. The less important organic produce is to people, the more likely they are to agree that genetic engineering is better than pesticides in protecting plants against pests. For example, 91 percent of those who said that organic produce was not at all important to them agreed that genetic engineering was better than using pesticides. In comparison, only 79 percent of those who said organic produce was very important to them felt the same way. This trend was reflected in whether people thought genetically engineered food could be considered organic or whether it should be sold in natural food stores. The less important that organic food was to people, the more likely they were to see genetically engineered food as organic and the less likely they were to agree that this

food should not be sold in natural food stores. What this suggests is that those most interested in organic produce are not in favor of either pesticides or biotechnology, even if the genetically engineered produce is grown without pesticides.

Label that produce

The vast majority (84 percent) of New Jersey's population also thinks that fruits or vegetables created by genetic engineering should have special labels on them. Preference for such labels seems to stem more from the consumer's desire to make an informed buying decision rather than to avoid genetically engineered foods. Sixty percent of the population would consider buying fresh vegetables if they were labeled as having been produced by genetic engineering. Similarly, people are also very much in favor (76 percent) of farmers voluntarily putting labels on their produce that say they were not genetically engineered. However, fewer people (58 percent) would spend the time while shopping to look for such labels. Again, informed choice, not avoidance seems to be the motivation. Forty-two percent of the people who said that they would look for produce labeled "not genetically engineered" also said that they would buy produce that was genetically engineered if it were labeled as such.

People are more likely to buy produce labeled 'genetically engineered' if they perceive it as organic and if they approve of genetic engineering over the use of pesticides. Potential buyers of food labeled 'genetically engineered' are also less likely to agree that genetically engineered food should not be sold in natural food shops. Not surprisingly, most of the people (85 percent) who would buy produce labeled 'genetically engineered' also approve of the genetic engineering of plants.

Again, people responded differently about how they felt about genetic engineering depending on the specific agricultural product involved. For example, far more people would be very willing or somewhat willing to buy genetically engineered apples (55 percent) than genetically engineered baby food (27 percent). In general, people indicated that they were more willing to buy genetically engineered fruits and vegetables than they were to buy genetically engineered milk or beef. As indicated in Table 7, people were most likely to say that they were "somewhat willing" or "not at all willing" to buy these products. This suggests that people may want more information before becoming "very willing" to buy a genetically engineered agricultural product.

In the absence of any specific benefits, much of the population appears reluctant to buy genetically engineered products. The less willing people said they were to buy any of these products, the more they would like to see farmers use labels saying that the produce is not genetically engineered. However, almost half those "very willing" to buy any of the products listed in Table 7 would also like to see the use of labels for produce that was not genetically engineered.

Contrary to what might be expected, parents of children under the age of five were no more likely to say that they were willing or unwilling to buy any of the genetically engineered foods, including baby food. However, people's willingness to buy genetically engineered produce does seem to be associated with their views of morality. The more likely people are to think that it is morally wrong to genetically engineer plants, the less willing they are to buy genetically engineered

produce. However, many of those "not at all willing" to buy genetically engineered produce do not see the genetic engineering of plants as morally wrong. For example, 51 percent of those who are not at all willing to buy genetically engineered apples do not see anything morally wrong with the genetic engineering of plants. However, there was a much stronger association with people's thoughts on the morality of genetically engineering animals and whether they would buy genetically engineered products, especially animal products. For example, 77 percent of people who were not at all willing to buy genetically engineered beef also thought it was morally wrong to genetically engineer animals.

Table 7: Consumer opinions about specific genetically engineered agricultural products

Question (21): Would you be very willing, somewhat willing, not very willing, or not at all willing to buy genetically engineered (ITEM) if it were the same price as similar products?

ITEM	Very willing	Somewhat willing	Not very willing	Not at all willing	Don't buy	Not sure /refused
Apples	17%	38%	13%	29%	<1%	2%
Corn	17	39	11	31	<1	1
Tomatoes	17	39	13	29	<1	2
Milk	13	25	16	44	<1	2
Beef	11	26	19	41	<1	2
Baby food	7	20	13	51	5	4

Based on weighted data

Quality of life

Over two-thirds of New Jersey's residents believe that genetic engineering will make the quality of life much better (20 percent) or somewhat better (49 percent) for people like themselves. New Jersey residents are more likely to agree that genetic engineering will enhance the quality of their lives if they are better educated, have heard or read more about genetic engineering and if their understanding of science and technology is high (see Table 8). While people who approve of genetic engineering of plants or animals are also more likely to think that genetic engineering will enhance the quality of life, 41 percent of those who disapprove of the genetic engineering of plants and 50 percent of those who disapprove of the genetic engineering of animals agree that genetic engineering will make the quality of life at least somewhat better for people such as themselves. However, it is interesting that one-in-seven New Jersey residents was unsure what effect genetic engineering would have on the quality of their lives.

Table 8: Genetic engineering and the quality of life

Question (27): From what you know or have heard, do you think genetic engineering will make the quality of life for people such as yourself better or worse?							
		Much better	Somewhat better	Somewhat worse	Much worse	Not Sure	Refused
	604 ^a	20%	49%	10%	6%	14%	1
Education							
< High school	42	20	32	10	21	17	<1
High school grad	169	15	46	17	4	17	<1
Some college	133	24	60	4	2	10	1
College grad	257	24	57	6	2	9	2
Heard of genetic engineering							
Great deal	69	40	43	1	6	7	3
Some	260	25	55	7	4	8	1
Not much	180	13	48	12	8	18	1
Nothing at all	92	13	42	14	6	23	2
Not sure	3	-	-	65	35	-	-
Understanding of science & Technology							
Very good	167	26	45	12	4	10	3
Adequate	327	19	54	7	6	13	<1
Poor	106	14	41	15	8	21	<1
Not sure	3	-	14	18	-	68	-
Refused	1	100	-	-	-	-	-
Approve of genetic engineering of plants							
Approve	406	29	59	3	<1	8	<1
Disapprove	154	5	36	24	20	14	2
Not sure	40	9	19	4	3	63	1
Refused	4	-	81	-	-	-	19
Approve of genetic engineering of animals							
Approve	186	39	52	4	-	5	<1
Disapprove	366	11	47	13	10	17	1
Not sure	45	27	48	-	-	25	-
Refused	7	14	61	25	-	-	-

^a Percentages are presented as weighted sample estimates. The unweighted sample base is presented in the first column so that sampling variances for these estimates can be calculated.

Job creation

Almost three out of four residents also mildly (37 percent) or strongly (36 percent) agree that genetic engineering will create jobs in New Jersey. This is particularly true of younger people (18-24), those with a higher education, those with higher incomes and those with a better understanding of science and technology.

People's awareness of genetic engineering did not appear to influence their decision about jobs. Not surprisingly, those who believe that genetic engineering will create jobs in New Jersey are more likely to approve of the genetic engineering of both plants and animals. However, believing that genetic engineering will create jobs does not necessarily lead people to approve of the technology. Of those who agree that the technology will create jobs in New Jersey, 19 percent disapprove of the genetic engineering of plants and 61 percent disapprove of the genetic engineering of animals.

An increase in the number of jobs in the Garden State would certainly increase the quality of life. As such there was a strong association between believing that genetic engineering would create jobs and the belief that genetic engineering would improve the quality of life. Interestingly,

there was no association between the belief that genetic engineering would create jobs in the State and income or political ideology or party affiliation.

Perceived risks

About half of New Jersey's residents mildly or strongly agree that the risks of genetic engineering have been greatly exaggerated. This is particularly true for younger people (18-24), better educated people, those with higher incomes, people who have read or heard more about genetic engineering and those with a greater understanding of science and technology. However, a third of the people who rated their understanding of science and technology as very good also disagreed that the risks of genetic engineering had been exaggerated. A similar proportion of those who approve of the genetic engineering of plants or animals do not believe the risks have been exaggerated. Many people (15 percent) said that they were not sure whether the risks had been exaggerated or not.

Concern about regulation of biotechnology

Although most of the population in New Jersey is accepting of biotechnology research and some of its potential products, they are also clearly in favor of close government control over this research. This concern regarding likely food products may be related to a general concern about the use of science and technology in producing food. More than eight in ten people are very concerned (40 percent) or somewhat concerned (41 percent) about government regulations of science and technology in producing food. Those most likely to be "very concerned" are women, those with less education, and people who consider themselves politically to be moderates. Almost two-thirds of the population strongly agrees (44 percent) or mildly agrees (21 percent) that "the potential danger from genetic engineering is so great that strict regulations are necessary." Only 28 percent either mildly or strongly disagree with this statement.

Almost two-thirds of the population (63 percent) also disagreed with the statement that "scientists in this country know what they are doing, so only moderate regulations on genetic engineering are probably necessary." Interestingly, scientists, engineers and those who said that they belonged to scientific organizations were no more likely to agree with this statement than non-scientists. Those in consumer and environmental groups were no more likely to disagree with this statement.

Clearly, there is general support for regulation of biotechnology. Even 63 percent of those who believe that the risks of genetic engineering have been exaggerated also believe that strict regulations are necessary. People most likely to support strict regulations are both younger (18-24) and older (60+) people, those with less education, people with a liberal political ideology, those who disapprove of genetic engineering of either plants or animals, and people who have heard a great deal about genetic engineering (see Table 9). Interestingly, 58 percent of the people who agreed that "scientists in this country know what they are doing, so only moderate regulations on genetic engineering are necessary," also agreed that strict regulations of genetic engineering are necessary.

While people are clearly in favor of government regulation, there is also majority agreement (57 percent) with the statement "unjustified fears about genetic engineering have seriously blocked

the development of beneficial foods," although 71 percent of these people also call for strict regulation. These results would tend to support the OTA conclusion that:

"The public recognizes both the unreasonable fears associated with genetic engineering as well as the real risks. The unreasonable fears are seen as having delayed significant benefits from this technology. But the public still comes down on the side of strict regulation of the technology because it perceives potential dangers from the innovations."

Table 9: Support of strict regulations on genetic engineering

Question (26a):	The potential danger from genetic engineering is so great that strict regulations are necessary. Do you agree or disagree?				
	Agree	Disagree	Not sure	Refused	
	604 ^a	65%	28%	7%	<1%
Age					
18-24	76	71	21	8	-
25-29	61	66	27	7	-
30-39	108	60	32	8	-
40-49	113	63	33	4	-
50-59	89	63	33	4	-
60+	144	68	25	6	<1
Education					
< High school	42	77	23	-	-
High school grad	169	62	25	12	<1
Some college	133	63	31	6	-
College grad	257	61	35	5	<1
Ideology					
Liberal	244	73	22	5	-
Moderate	43	63	26	10	1
Conservative	306	59	34	7	<1
Don't know	7	81	10	10	-
Refused	4	77	23	-	-
Heard of genetic engineering					
Great deal	69	72	27	1	-
Some	260	65	29	5	<1
Not much	180	63	28	9	-
Nothing at all	92	67	25	8	<1
Not sure	3	-	100	-	-
Approve of genetic engineering of plants					
Approve	406	61	34	6	-
Disapprove	154	74	20	6	-
Not sure	40	58	19	20	3
Refused	4	64	36	-	-
Approve of genetic engineering of animals					
Approve	186	54	43	3	-
Disapprove	366	71	22	7	<1
Not sure	45	53	25	20	1
Refused	7	52	48	-	-

^a Percentages are presented as weighted sample estimates. The unweighted sample base is presented in the first column so that sampling variances for these estimates can be calculated.

Environment

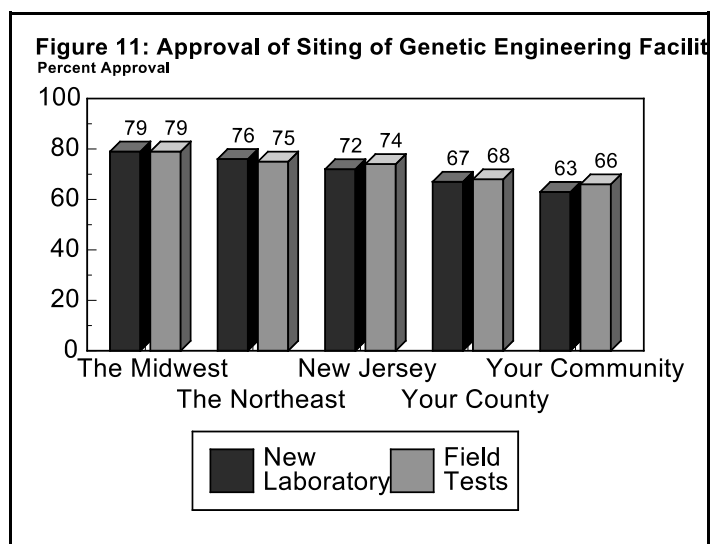
Concerns about possible risks to the environment are fairly polarized. About 40 percent of the population believe that new genetically engineered plants or animals could pose a likely threat to the environment if it could reproduce. However, a slightly higher proportion of people (46 percent) do not think such a threat is likely. More than one-in-ten people are not sure whether such

a threat is likely or not likely, suggesting they would like further information before deciding.

Those who belong to environmental groups believe that the threat to the environment from genetically engineered plants or animals is more likely than those not affiliated with such groups. This was not true of those who belong to consumer or scientific groups, however. Similarly, those whose occupation involves growing food or the medical profession did not think the threat to the environment is any more or less likely than those not in those professions. However, those who prepare or sell food believe that such a threat is more likely and those who are scientists or engineers believe that such a threat is less likely than those who are not members of these professions.

Siting of research

One interesting test of how people really feel about the dangers of biotechnology research is reflected in what people would think if it were done in their community. As mentioned previously, most people think that genetic engineering will create jobs (65 percent) and improve the quality of life (69 percent). It follows then, that most people would be likely to favor a new genetic engineering laboratory or farm test site in their local community. The survey showed that most of New Jersey's residents approved of such facilities no matter where they were located (see Figure 11). However, the closer a laboratory or farm test site was to the local community, the less support there was. Interestingly, there was little difference in the rates of approval or disapproval, whether the research facility was a relatively closed laboratory or relatively open field testing on a farm.



Credibility of "expert" sources of information

The nature and degree of risk in applying new technology is rarely agreed upon. With increasing debate about the issues surrounding new biotechnology, the public frequently wonders who can be believed or trusted. The 1987 OTA survey found that the public is most likely to believe risk statements made by university scientists and less inclined to believe statements made by federal agencies, public interest groups, local officials, companies making the product or news media. The results of this survey backs up these results (see Table 10) with scientists being the most credible and companies that make genetically engineered products being the least credible. Local farmers and environmental groups are also far more likely to be believed than state or federal government agencies. This apparent lack of belief in government agencies could prove problematic in future debates about the regulation of biotechnology.

Scientists and engineers are more likely to believe statements made by university scientists

and extension agents, and those involved with growing food are more likely to believe statements made by farmers. However, those who belong to scientific organizations were less likely to believe statements made by farmers, and those who prepare or sell food were less likely to believe what university scientists have to say. On the other hand, medical professionals and those who belong to environmental or consumer groups were statistically no more or less likely to believe statements by any of the experts.

Table 10: Credibility of sources of statements about genetic engineering

Question (27): Would you say you had a great deal of faith, some faith, or little faith in statements about genetic engineering made by (ITEM)?					
ITEM	Great deal of faith	Some faith	Little faith	Don't know	No Answer
University scientists	23%	48%	18%	11%	-
Local farmers	16	45	31	8	-
Environmental groups	19	40	32	9	-
Rutgers Coop. Ext. Service	21	34	15	30	-
New Jersey State Govt. agencies	8	37	43	11	1
U.S. Government agencies	7	34	49	8	2
Companies that make genetically engineered products	5	31	53	11	-

Based on weighted data

Support for genetic engineering research

Most of New Jersey's population believes that research into genetic engineering should be continued. Almost eight out of ten people say that research into genetic engineering should be continued at the same level (44 percent) or increased (34 percent). Only 9 percent of the New Jersey public feels that genetic research should be stopped altogether, and another 9 percent believe it should be decreased. Support for increasing research in genetic engineering was highest among younger people (18-29), males, those with some college education, people earning over \$70,000 a year, Protestants, those who had heard a great deal about genetic engineering and those who have a very good understanding of science and technology (see Table 11). Not surprisingly, those who believe that genetic engineering will create jobs in New Jersey, and improve the quality of life also support increased spending on biotechnology.

The majority of people (51 percent) who approved of the genetic engineering of plants thought that research should continue at the same level. In addition, four in ten respondents (43 percent) thought it should be increased. Interestingly enough, 18 percent of people who disapprove of the genetic engineering of plants thought research should increase and another 33 percent of these people thought it should continue at the same level. An even higher proportion of those disapproving of genetic engineering of animals thought research should be increased (24 percent) or continued at the same level (46 percent).

Table 11: Support for genetic engineering research

Question (35): Do you think that research into genetic engineering should be increased, continued at the same level, decreased or stopped altogether?

	Increased	Same level	Decreased	Stopped	Not sure	Refused	
604^a	34%	44%	9%	9%	4%	<1	
Sex							
Male	302	40	38	6	13	3	<1
Female	302	27	51	12	5	5	<1
Age							
18-24	76	46	39	12	1	2	-
25-29	61	46	34	9	11	-	-
30-39	108	30	48	5	11	5	-
40-49	113	37	43	5	11	5	-
50-59	89	35	35	13	14	4	<1
60+	144	23	54	11	7	5	<1
Education							
< High school	42	20	45	7	25	3	-
High school grad	169	26	46	14	8	5	-
Some college	133	47	38	7	3	5	<1
College grad	257	43	48	4	3	2	<1
Income							
< \$10,000	18	23	46	7	24	-	-
\$10-20,000	58	20	46	15	12	6	-
\$20-30,000	76	31	35	15	20	-	-
\$30-50,000	162	32	50	9	4	5	-
\$50-70,000	98	40	46	6	6	3	-
> \$70,000	121	51	39	3	2	4	<1
Don't know	4	59	10	15	-	16	-
Refused	4	54	30	16	-	-	-
Religion							
Catholic	270	31	47	9	10	3	<1
Protestant	142	40	45	4	3	7	<1
Jewish	42	38	47	6	3	5	-
Other	122	33	41	10	13	3	-
None	15	32	30	21	18	-	-
Don't know/refused	13	15	39	16	9	21	-
Heard of genetic engineering							
Great deal	69	62	27	4	6	1	-
Some	260	39	46	9	3	3	<1
Not much	180	26	45	9	14	6	<1
Nothing at all	92	23	48	11	12	6	-
Not sure	3	-	-	-	100	-	-
Understanding of science & Technology							
Very good	167	40	38	10	7	4	<1
Adequate	327	34	47	7	9	3	<1
Poor	106	26	47	12	9	7	-
Not sure	3	14	18	-	68	-	-
Refused	1	100	-	-	-	-	-

^a Percentages are presented as weighted sample estimates. The unweighted sample base is presented in the first column so that sampling variances for these estimates can be calculated.

Conclusions

Although New Jersey citizens rate their own understanding of science and technology above the national average, most residents have heard or read very little about genetic engineering. Moreover, it was evident through the monitoring of many interviews, and through debriefing the interviewers that many respondents had not thought a great deal about the issues surrounding biotechnology. Many respondents were quite introspective, carefully considering their answers, as if they were really thinking about the issues for the first time.

It also appears that even most of those who have thought a great deal about biotechnology

did not approach the issues in the survey ideologically, but rather individually. For example, many who disapproved of genetic engineering in the abstract did approve of specific agricultural products created through biotechnology. In short, most citizens seem to be in the initial stages of making up their minds about this new technology and have not decided that products of agricultural biotechnology are universally acceptable or unacceptable.

Much of this suggests that while the battle over biotechnology has raged between experts, most of the shots have passed over the heads of the noncombatants. This will undoubtedly change soon. As agricultural products developed using biotechnology reach the supermarket, consumers will be faced with making decisions about real products, not just abstract ideas. Since agricultural biotechnology will ultimately survive or perish in the marketplace, both opponents and supporters of biotechnology are expected to intensify their efforts to educate and to influence consumers.

The results of this survey suggest that much education remains to be done and that both sides in the debate may face difficulties in their efforts. For example, arguments that genetic engineering is the logical extension of traditional crossbreeding techniques will probably be lost on all but the 28 percent of the population who are aware that they have ever eaten a fruit or vegetable produced through crossbreeding. Similarly, opponents of biotechnology may have difficulty convincing the 17 percent of the population who believe they are already eating genetically engineered produce, that it has had any harmful effect on them.

Proponents may also have a difficult time getting past very negative images evoked by the term "genetic engineering." They will also have to deal with much of the uncertainty concerning the safety of biotechnological products and processes. Opponents may have difficulty with peoples' willingness to consider genetically engineered produce as "natural," and their apparent willingness to buy the products of biotechnology even if they morally object to the process used to create them.

Despite their lack of awareness, most New Jersey residents appear to support genetic engineering research, if it is related to plants or medicine. The majority also believe that genetic engineering will increase the number of jobs in the state and improve the quality of life for people like themselves. The more people had heard or read about genetic engineering, and the greater their understanding of science and technology, the more they supported biotechnology. While it is tempting to draw the conclusion from this that more education about science, technology and genetic engineering would lead to greater consumer acceptance, correlation does not imply causation. That is, people with greater education overall may be more willing to entertain new ideas and technologies, and that providing people with specific information about biotechnology may not have the same effect.

In terms of providing information about biotechnology, New Jersey residents are far more inclined to believe scientists, local farmers and environmental groups than government agencies or biotechnology companies. The lack of trust in the two institutions with the greatest resources and responsibilities for ensuring the safety of agricultural biotechnology must be seen as an important obstacle to honest discussions about the merits of this new technology. It suggests that government agencies and commercial concerns need to take a more proactive role in community discussions and debates about genetic engineering, especially as they relate to consumer fears and preferences.

If these institutions are to be perceived as credible concerning biotechnology in the long run, they must be consistently credible on the issues in the short run.

About half the population believes that the risks of genetic engineering have been exaggerated, and the majority think that unjustified fears of biotechnology have blocked the development of beneficial foods. Most would like to see genetic engineering research continued at the same level or increased. Most would also not object to having a biotechnology research laboratory or a field test in their community. Despite this, and their lack of trust in information provided by the government, many people are quite uncertain about the risks posed by biotechnology, and most feel that strict regulations are necessary to ensure the safety of biotechnology research.

Most of New Jersey's residents are very opposed to any sort of genetic manipulation of animals, either through traditional cross-breeding or genetic engineering. Even many of those who support the genetic engineering of plants oppose using biotechnology on animals. This has clear implications for the introduction of agricultural products produced through genetic engineering. If the general strategy of companies involved in agricultural biotechnology is to achieve initial consumer acceptance of genetically engineered products, they may achieve greater success if their first offerings appear in the produce section of the supermarket rather than the meat counter.

Wherever the products of agricultural biotechnology appear in the supermarket, most New Jersey consumers want them labeled. Whatever their position on biotechnology, most consumers favor label information indicating whether a food is the product of biotechnology or not. Consumer choice seems to be the main motivating factor. Many of those who approve of genetic engineering, and said that they would be willing to buy biotech products thought that providing special labels would be a good idea. Issues of practicality aside, encouraging such labels would probably be politically popular with consumers.

Finally, it appears that most people have not made up their minds about agricultural biotechnology. While most people are relatively optimistic about the benefits of the new technology, many are quite unsure about its potential risks. As such, they would like strict government controls, to keep such risks in check. They would also like special labels on the products of biotechnology, to give consumers more immediate control over their exposure to any potential risks.

Based on the results of this survey, it appears that many people may ultimately approve of, and perhaps even buy agricultural products produced through biotechnology. But what people say they believe, and what they will do is not always a reliable measure of what actions people will actually take. Public perceptions of agricultural biotechnology will continue to change, especially as genetically engineered products make their way to market. As such, this survey must be seen as a snapshot. It provides some insight, but many unanswered questions. As events unfold, new studies must be undertaken to help understand and interpret public opinion.

Survey Methodology

Selection of the Sample

The sample was drawn from the noninstitutionalized civilian population of adults (aged 18 and older) in New Jersey. A statewide sample was developed by the Eagleton Poll using the following steps.

The initial stage of sample construction starts with a complete list of all the residential telephone exchanges that are in use throughout the State. The list notes the "exchange area" served by each three-digit telephone exchange, designated by the name of a municipality. All of the exchanges and their associated municipality are arrayed by each of the twenty-one New Jersey counties, along with the number of residential and business lines currently active for each.

Quotas are then established to decide how many interviews should come from each county to make up the total sample size. These quotas are equivalent to the county's contribution to the total number of New Jersey residents who are aged eighteen or older. The proportions used to calculate the numerical quotas are based on U.S. census figures.

In the next step, a sample of 600 telephone exchanges is selected, stratified by county. For each county, each exchange (or cluster of exchanges) is examined to decide what proportion of all of the county's residential telephone lines go to that exchange. This proportion is used to determine how many people should be sampled from each exchange to make up the total county quota.

After the sample of three digit telephone exchanges was selected, the remaining four digits were selected. To accomplish this, for each exchange selected, the current telephone directory listing that exchange was consulted. A page was then randomly selected from the directory, and the first residential phone number beginning with the selected exchange was located. The last two digits from the last four in that telephone number are used to increase the chances of calling a working set of numbers in that particular exchange. To randomly complete the number, the last two digits from the number immediately following on the page are used, whatever its exchange.

When this process is completed, a sample of 600 base numbers is drawn. New samples are created by adding one to the last digit in each phone number, generating 600 new numbers. Using this process, only the last two digits of the phone number are altered, resulting in a maximum of ninety-nine additional samples.

In the field, interviewers begin with one number. If that number is not workable for whatever reason, they use their original number generate a new number by adding a one to the third digit from the right. This results in a maximum of nine additional numbers that can be tried. If all ten of the numbers turn out not to be workable, a new base number is generated using the process outlined above.

Study: Biotechnology Survey
 May 11 Draft 6

Interviewer: _____ Date: _____

Telephone No.:

S))))))))))

Hello, I'm _____(first and last name). I'm on the staff of the Eagleton Poll, an I'm taking a public opinion survey of New Jersey Adults for Rutgers University

1. To begin with, would you rate your own basic understanding of how food is grown and produced as:

- Very good (01(__-1
- Adequate __-2
- Poor __-3
- Not sure __-4
- Refused/No answer __-5

2. Would you rate your own basic understanding of science and technology as:

- Very good (02(__-1
- Adequate __-2
- Poor __-3
- Not sure __-4
- Refused/No answer __-5

3. How concerned are you about government regulations concerning the use of science and technology in producing food -- are you very, somewhat, not very, or not concerned at all?

- Very concerned (03(__-1
- Somewhat concerned __-2
- Not very concerned __-3
- Not at all concerned __-4
- Not sure __-5
- Refused/No answer __-6

3a. Is anyone in your family allergic to particular foods?

- Yes (04(__-1
- No __-2
- Not sure __-3
- Refused/No answer __-4

4a Do you ever shop in "natural" or "organic" food stores?

- Yes (04(__-1
- No __-2
- Not sure __-3
- Refused/No answer __-4

4. Have you ever seen fresh fruits or vegetables labeled "organic" or "pesticide free" in the places where you normally shop?
- Yes (04(__-1
 No __-2
 Not sure __-3
 Refused/No answer __-4
5. In the places where you normally shop, how many of the fresh fruits and vegetables would you say were treated with chemicals at some point. Would you say:
- All of them (05(__-1
 Most of them __-2
 Some of them __-3
 None of them __-4
- Not sure __-5
 Refused/No answer __-6
6. How important is it that the fruits and vegetables you eat are grown organically, -- is it:
- Very important (06(__-1
 Somewhat important __-2
 Not very important __-3
 Not at all important __-4
- Not sure __-5
 Refused/No answer __-6
- 10a. To create hybrid plants, the pollen of one variety of plant is used to cross-fertilize another variety. A similar method is used to cross-breed varieties of chickens or varieties of cows or varieties of other animals. Have you heard about these methods?
- Yes (17(__-1
 No __-2
 Not sure __-3
 Refused/No answer __-4
- 10b. As far as you know, have you ever eaten a fruit or vegetable created using these methods?
- Yes (18(__-1
 No __-2
 Not sure __-3
 Refused/No answer __-4
- 10c. In general, do you approve or disapprove of creating hybrid plants using these methods?
- Approve (19(__-1
 Disapprove __-2
 Not sure __-3
 Refused/No answer __-4
- 10d. Do you believe that creating hybrid plants using these methods is morally wrong or not?

Morally wrong (20(__-1
 Not wrong __-2
 Depends (Vol.) __-3
 Not sure __-4
 Refused/No answer __-5

10e. In general, do you approve or disapprove of creating hybrid animals using these methods?

Approve (19(__-1
 Disapprove __-2
 Not sure __-3
 Refused/No answer __-4

10f. Do you believe that creating hybrid animals using these methods is morally wrong or not?

Morally wrong (20(__-1
 Not wrong __-2
 Depends (Vol.) __-3
 Not sure __-4
 Refused/No answer __-5

11. My next question involves word association. For example, when I mention the word *baseball*, you might think of the World Series, Babe Ruth, summertime, or even hot dogs. Today, I am interested in the first thoughts or images that come to mind when you think of genetic engineering.

11a. When you think about genetic engineering, what is the first thought or image that comes to mind?
 (21(

12a. Genetic engineering involves new methods that make it possible for scientists to create new plants and animals by taking parts of the genes of one plant or animal and inserting them into the cells of another plant or animal. This is sometimes called gene splicing or biotechnology. How much have you heard or read about these methods?

A great deal (24(__-1
 Some __-2
 Not much __-3
 Nothing at all __-4
 Not sure __-5
 Refused/No answer __-6

12b. As far as you know, have you ever eaten a fruit or vegetable created using genetic engineering methods?

Yes (25(__-1
 No __-2
 Not sure __-3
 Refused/No answer __-4

- 12c. Do you think that fruits or vegetables or other foods created through genetic engineering should have special labels on them?

Yes (26(____-1
 No ____-2
 Not sure ____-3
 Refused/No answer ____-4

13. If you were shopping for fresh vegetables and you saw some that were labeled as having been produced using genetic engineering, would you consider buying them or not?

Yes, would consider buying (28(____-1
 No, would not consider buying ____-2
 Not sure ____-3
 Refused/No answer ____-4

14. Some farmers might voluntarily start putting labels on their produce that says that the fruits and vegetables were not genetically engineered. Would you like to have these labels?

Yes (29(____-1
 No ____-2
 Not sure ____-3
 Refused/No answer ____-4

15. When you are shopping would you take the time to look for fruits and vegetables that carried labels stating that they were not genetically engineered?

Yes (30(____-1
 No ____-2
 Not sure ____-3
 Refused/No answer ____-4

- 16a. In general, do you approve or disapprove of creating hybrid plants using genetic engineering?

Approve (19(____-1
 Disapprove ____-2
 Not sure ____-3
 Refused/No answer ____-4

- 16b. Do you believe that creating hybrid plants using these methods is morally wrong or not?

Morally wrong (20(____-1
 Not wrong ____-2
 Depends (Vol.) ____-3
 Not sure ____-4
 Refused/No answer ____-5

- 16c. In general, do you approve or disapprove of creating hybrid animals using genetic engineering?

Approve (19) ___-1
 Disapprove ___-2
 Not sure ___-3
 Refused/No answer ___-4

16d. Do you believe that creating hybrid animals using these methods is morally wrong or not?

Morally wrong (20) ___-1
 Not wrong ___-2
 Depends (Vol.) ___-3
 Not sure ___-4
 Refused/No answer ___-5

18. If the new plant or animal produced by genetic engineering could reproduce itself, do you think it would be very likely, somewhat likely, somewhat unlikely or very unlikely to pose a danger to the environment?

Very likely (33) ___-1
 Somewhat likely ___-2
 Somewhat unlikely ___-3
 Very unlikely ___-4
 Not sure ___-5
 Refused/No answer ___-6

19. How much faith would you have in statements about genetic engineering made by {Read item} _____? Would you say: a great deal of faith, some faith, or little faith? If you don't feel you know enough about the agency, just say you don't know.

ROTATE

		Great Deal	Some	Little	Don't Know	Refused/ Answer
a. U.S. Government agencies	(35)	___-1	___-2	___-3	___-4	___-5
d. New Jersey State Government agencies	(38)	___-1	___-2	___-3	___-4	___-5
e. The Rutgers Cooperative Extension Service	(39)	___-1	___-2	___-3	___-4	___-5
f. University scientists	(40)	___-1	___-2	___-3	___-4	___-5
g. Local farmers	(41)	___-1	___-2	___-3	___-4	___-5
i. Companies that make genetically engineered products	(40)	___-1	___-2	___-3	___-4	___-5
j. Environmental groups	(43)	___-1	___-2	___-3	___-4	___-5

20. Based on what you know, do you approve or disapprove of scientists using genetic engineering methods to create __
 __ (READ ITEM) -- PROBE: do you

ROTATE

	<u>Strongly Approve</u>	<u>Somewhat Approve</u>	<u>Somewhat Disapprove</u>	<u>Strongly Disapprove</u>	<u>Not Sure</u>	<u>Refused/ No Answer</u>
a. bacteria to clean up oil spills	(44(__-1	__-2	__-3	__-4	__-5	__-6
b. better tasting fruits and vegetables	(45(__-1	__-2	__-3	__-4	__-5	__-6
c. fruits and vegetables that last longer on a supermarket shelf	(46(__-1	__-2	__-3	__-4	__-5	__-6
d. fruits and vegetables that are less expensive	(47(__-1	__-2	__-3	__-4	__-5	__-6
e. new drugs to cure human disease	(48(__-1	__-2	__-3	__-4	__-5	__-6
f. hormones like insulin that help people with diabetes	(49(__-1	__-2	__-3	__-4	__-5	__-6
g. hormones that enable cows to give more milk	(50(__-1	__-2	__-3	__-4	__-5	__-6
h. hormones that enable cows to produce more beef	(51(__-1	__-2	__-3	__-4	__-5	__-6
i. more nutritious grain that could feed people in poor countries	(52(__-1	__-2	__-3	__-4	__-5	__-6
i. hormones that enable cows to produce beef with less cholesterol	(53(__-1	__-2	__-3	__-4	__-5	__-6
j. new types of grass that don't need to be mown as often	(54(__-1	__-2	__-3	__-4	__-5	__-6
k. fruits and vegetables that have their own chemical defenses against insects	(55(__-1	__-2	__-3	__-4	__-5	__-6

21. How willing would you be to buy genetically engineered {Read Item} if it were the same price as similar products?

ROTATE

	<u>Very Willing</u>	<u>Somewhat Willing</u>	<u>Not Very Willing</u>	<u>Not at all Willing</u>	<u>Don't Know</u>	<u>Refused/No Answer</u>
a. Apples	(72(__-1	__-2	__-3	__-4	__-5	__-6
b. Corn	(73(__-1	__-2	__-3	__-4	__-5	__-6
c. Milk	(74(__-1	__-2	__-3	__-4	__-5	__-6
d. Tomatoes	(75(__-1	__-2	__-3	__-4	__-5	__-6
e. Beef	(76(__-1	__-2	__-3	__-4	__-5	__-6
e. Baby food	(76(__-1	__-2	__-3	__-4	__-5	__-6

22. All plants, whether they are genetically engineered or not, contain natural chemicals that help protect them from some pests and diseases. Using genetic engineering, scientists can grow plants that contain more of those chemicals, so farmers don't have to use as many pesticides. Please tell me whether you tend to agree or disagree with each of the following statements about these kinds of plants. (READ EACH STATEMENT)

ROTATE

	<u>Agree</u>	<u>Disagree</u>	<u>Not Sure</u>	<u>Refused/No Answer</u>
a. Growing genetically engineered plants that contain higher levels of naturally occurring chemicals that protect against pests and disease is better than using pesticides	(64(__-1	__-2	__-3	__-4
b. Food that is produced from genetically engineered plants that contain higher levels of naturally occurring chemicals that protect against pests and disease should be considered "organic"	(65(__-1	__-2	__-3	__-4
c. Food that is produced from genetically engineered plants that contain higher levels of naturally occurring chemicals that protect against pests and disease should not be sold in "natural" food stores	(66(__-1	__-2	__-3	__-4

ROTATE Q23 AND Q24 (but maintain order within questions).

23. From what you know about genetic engineering would you approve, or disapprove of a new laboratory that does genetic engineering on plants somewhere in [READ ITEM]

	<u>Approve</u>	<u>Disapprove</u>	<u>Not Sure</u>	<u>Refused/ no answer</u>
a. The Midwest	(67(__-1	__-2	__-5	__-6
b. The Northeast	(68(__-1	__-2	__-5	__-6
c. New Jersey	(69(__-1	__-2	__-5	__-6
d. Your County	(70(__-1	__-2	__-5	__-6
e. Your Community	(71(__-1	__-2	__-5	__-6

24. As part of their research on new plants created using genetic engineering methods, scientists must test them on farms. All

tests must first be approved by the government and are closely monitored. From what you know about genetic engineering, would you strongly approve, somewhat approve, somewhat disapprove or strongly disapprove if the tests were done on a farm somewhere in [READ ITEM]

	<u>Approve</u>	<u>Disapprove</u>	<u>Not Sure</u>	<u>Refused/ no answer</u>
a. The Midwest	(72(__-1	__-2	__-5	__-6
b. The Northeast	(73(__-1	__-2	__-5	__-6
c. New Jersey	(74(__-1	__-2	__-5	__-6
d. Your County	(75(__-1	__-2	__-5	__-6
e. Your Community	(76(__-1	__-2	__-5	__-6

26. Now I will read you a few statements. For each, please tell me whether you agree strongly, agree somewhat, disagree somewhat, or disagree strongly [READ EACH ITEM]

ROTATE

	<u>Agree Strongly</u>	<u>Agree Somewhat</u>	<u>Disagree Somewhat</u>	<u>Disagree Strongly</u>	<u>Not Sure</u>	<u>Refused/ No Answer</u>
a. The potential danger from genetic engineering is so great that strict regulations are necessary	(78(__-1	__-2	__-3	__-4	__-5	__-6
b. The risks of genetic engineering have been greatly exaggerated	(79(__-1	__-2	__-3	__-4	__-5	__-6
c. Genetic engineering will create jobs in our state	(80(__-1	__-2	__-3	__-4	__-5	__-6
d. It would be better if we did not know how to do genetic engineering at all	(81(__-1	__-2	__-3	__-4	__-5	__-6
e. Scientists in this country know what they are doing, so only moderate regulations on genetic engineering are probably necessary . .	(82(__-1	__-2	__-3	__-4	__-5	__-6
f. Unjustified fears about genetic engineering have seriously blocked the development of beneficial foods	(83(__-1	__-2	__-3	__-4	__-5	__-6
g. We have no business meddling with nature	(84(__-1	__-2	__-3	__-4	__-5	__-6

27. From what you know or have heard, do you think genetic engineering will make the quality of life for people such as yourself better or worse? Probe:

- Much better (85(____-1
 Somewhat better ____-2
 Somewhat worse ____-3
 Much worse ____-4
- Refused/No answer ____-5

28. Do you think that research into genetic engineering should be increased, continued at the same level, decreased or stopped altogether?

- Increased (86(____-1
 Continued at the same level ____-2
 Decreased ____-3
 Stopped altogether ____-4
- Refused/No answer ____-5

29. Some reports in the media have suggested that as much as one third of the chicken in U.S. supermarkets may contain bacteria that can cause food poisoning. Food scientists have developed a way to kill these bacteria using very low levels of radiation. Would you strongly approve, somewhat approve, somewhat disapprove or strongly disapprove of using radiation to kill bacteria on chickens?

- Strongly approve (87(____-1
 Somewhat approve ____-2
 Somewhat disapprove ____-3
 Strongly disapprove ____-3
 Not sure ____-4
 Refused/No answer ____-5

Now, I'd like to ask you a series of questions for classification purposes.

30. How old are you? (88(____ years of age

31. What is the last year or grade of school you completed?

- No formal schooling (89(____-1
 First through 7th grade ____-2
 8th grade ____-3
 Some high school ____-4
 High school graduate ____-5
 Some college ____-6
 Four-year college graduate ____-7
 Post graduate ____-8
 Refused/No answer ____-9

32. Are you presently employed full time, part time, in the military, unemployed, retired and not working, a student, a homemaker, or are you disabled or too ill to work?

Employed full time (90(____-1
 Employed part time ____-2
 In the military ____-3
 Unemployed ____-4
 Retired ____-5
 Student ____-6
 Homemaker ____-7
 Disabled/too ill to work ____-8
 Refused/No answer ____-9

(If 4,5,6,7,8,9 SKIP to Q34)

33. Does your job involve:

- a. Growing, or processing food?

Yes (91(____-1
 No ____-2
 Not sure ____-3
 Refused/No answer ____-4

- b. Preparing or selling food?

Yes (92(____-1
 No ____-2
 Not sure ____-3
 Refused/No answer ____-4

- c. Are you a scientist or engineer?

Yes (93(____-1
 No ____-2
 Not sure ____-3
 Refused/No answer ____-4

- d. Are you a medical professional?

Yes (94(____-1
 No ____-2
 Not sure ____-3
 Refused/No answer ____-4

34. Are you a member of (READ ITEM)?

	<u>Yes</u>	<u>No</u>	<u>Not Sure</u>	<u>Refused/ No answer</u>
a. Environmental groups or organizations	(95(____-1	____-2	____-3	____-4
b. Scientific groups or organizations	(96(____-1	____-2	____-3	____-4
c. Consumer groups or organizations	(97(____-1	____-2	____-3	____-4

35. Do you do most of the food shopping for your household?

Yes (98(____-1
 No ____-2
 No, equally divided ____-3

 Not sure ____-3
 Refused/No answer ____-4

36. Do you have any children who are younger than 21 years old?

Yes (99(____-1
 No ____-2
 Don't Know ____-3

If YES to Q36

37. How many of your children are:

a. Age 5 or under? (100(____
 b. Between 6 and 10? (101(____
 c. Between 11 and 15? (102(____
 d. Between 16 and 21? (103(____

38. During the past year, did you attend a church or synagogue or other house of worship?

Yes, about once a week or more (105(____-1
 Yes, about one or twice a month ____-2
 Yes, less than once a month but more than
 once or twice a year ____-3
 Yes, once or twice a year ____-4
 Not at all in the past year ____-5
 Refused/No answer ____-6

39. In politics as of today, do you consider yourself a Democrat, Republican, Independent, or something else?

Democrat (106(____-1
 Republican ____-2
 Independent ____-3
 Something else/Other ____-4
 Don't know / No opinion ____-9

(If #3, 4 or 9 to Q39, ASK:

Do you lean more toward the Democratic Party or more toward the Republican Party?

Democratic Party (106(____-1
 Republican Party ____-2
 Other Party ____-3
 Neither ____-4
 Don't know / No opinion ____-9

40. Regardless of the political party you might favor, do you consider yourself to be a liberal, conservative, or somewhere in between?

Liberal (107(____-1
 Conservative -2

Somewhere in between -3
 Don't know/ no opinion -9

(IF #3 or #9 to Q40 ASK:

Do you lean more toward the liberal side or more toward the conservative side?

Liberal (107(____-1
 Conservative -2
 Other/Neither -3
 Don't know/ no opinion -9

41. Do you consider yourself to be Catholic, Protestant, Jewish, or something else?

Catholic (108(____-1
 Protestant -2
 Jewish -3
 None/Atheist/Agnostic -4
 Other -5
 Don't know/ refused -6

42. Which of the following income categories best described your total income last year? Was it (READ EACH ITEM)?

\$7,500 or less (108(____-1
 \$7,501 to \$15,000 -2
 \$15,001 to \$25,000 -3
 \$25,001 to \$35,000 -4
 \$35,001 to \$45,000 -5
 \$45,001 to \$55,000 -6
 \$55,001 to \$65,000 -7
 \$65,001 to \$75,000 -8
 \$75,001 and over -9

Not sure/refused -0

RECORD SEX (DO NOT ASK)

Male (109(____-1
 Female -2