Public Perceptions of Genetically Modified Foods

Americans Know Not What They Eat

by

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Executive Summary

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Biotechnology stands to be a defining technology in the future of food and agriculture. Proponents argue that science and industry are poised to bring consumers a wide variety of products that have potential for meeting basic food needs, as well as delivering a wide-range of health, environmental and economic benefits. Opponents counter that the potential exists for unintended consequences, ranging from ecological disruption to adverse human health implications, and that these risks are not fully understood. Fundamental questions exist, however, regarding the general public's position on food products derived with the use of biotechnology.

To address these questions, the Food Policy Institute addressed consumers using computer-assisted telephone interviews (CATI) system, a public phone survey of a sample selection of 1203 U.S. residents was administered between March and April 2001. The questionnaire was developed to address perceived gaps in the current literature on American consumer awareness, acceptance, and perceptions of food biotechnology and to serve as the basis for a set of longitudinal studies that will be able to track public opinion over time. Below is a summary of principal discoveries for this study.

Among most Americans, there appears to be little awareness concerning the genetic modification of agricultural and food products.

- Biotechnology is clearly not a topic of conversation for most Americans, with fewer than one in three Americans (31%) claiming to have ever discussed the topic with anyone.

Only two in five Americans (41%) are aware that genetically modified food products are currently for sale in supermarkets.

- A third of Americans (32%) do not believe genetically modified products are actually in food stores, while a quarter of Americans (28%) are not sure.

- In contrast, one in five Americans (20%) believes they have eaten a fruit or vegetable that has been genetically modified despite the fact few are currently available in the marketplace.

Americans tend to overestimate their understanding of food production. Three-quarters of Americans (75%) claim their understanding to be at least 'good.' However:

- Half of the respondents (50%) had never heard of traditional crossbreeding methods when described in simple terms.

- Despite the fact that nearly all foods available today are the result of crossbreeding, three in five respondents (61%) claim never to have eaten a fruit or vegetable created using these methods.

- Americans also tend to overestimate their knowledge of science and technology. Nearly seven in ten Americans (66%) reported that their knowledge was at least 'good'. Yet:

Almost one in four Americans (24%) incorrectly believe that ordinary tomatoes do not contain genes.

- Nearly one in three respondents (27%) did not know that 'the father's genes determine whether the child is a girl.'

- Most of the questions in the science and technology quiz were asked in a 1999 survey of consumer attitudes given in the European Union. Comparative results suggest that Americans know more about these basic facts than their European counterparts.

Many Americans have no real first thought or image that they associate with the terms biotechnology, genetic engineering or genetic modification.

- In a free association exercise, 'biotechnology' evoked the least negative images for people (10%) and the terms 'genetic modification' and 'genetic engineering' are seen as more negative (25% and 21% respectively).

The data suggests that Americans have not made up their minds about genetic modification overall. However, they do express greater support for the genetic modification of plants than they do for animals.

- Over half of Americans approve (58%) of creating hybrid plants via genetic modification, while slightly more than one-quarter (28%) approve of the genetic modification of animals.

- One in five respondents (22%) believes that creating hybrid plants through genetic modification is morally wrong, and over half of respondents (55%) view the genetic modification of animals as morally wrong.

Approval of genetic modification rises considerably when individuals are presented with specific products with specific benefits. For example:

- More than four in five Americans approve of the use of genetic modification to create more nutritious grain to feed people in developing countries or to produce rice with enhanced Vitamin A to prevent blindness (85% and 80%, respectively).

- Three in four respondents (76%) say they would approve of the use of genetic modification to create sheep whose milk could be used to produce medicine and vaccines.

- Nearly three-quarters of Americans (74%) would approve of genetic modification if used to create less expensive or better tasting produce and slightly more respondents (76%) approve of genetically modified grass that would not have to be mowed so often.

Despite some reservation, three in five Americans (60%) believe that genetic modification will make the quality of their lives better. A slightly higher percentage (62%) believe that genetically modified foods will benefit many people.

- According to three in five Americans (61%), 'unjustified fears about genetic modification have seriously blocked the development of beneficial foods.'

Though nearly two-thirds of Americans (66 %) believe genetically modified foods will benefit many people, many also express concern about the potential risks of biotechnology.

- More that half of the respondents (56%) say that, 'the issue of genetic modification causes them great concern.'

A large segment of the U.S. public expresses concern over the potential ecological impacts of genetically modified organisms.

- Nine in ten Americans (90%) agree that 'the balance of nature can be easily disrupted by humans.'

- Three-quarters of the respondents (75%) believe 'nature is so complex that it is impossible to predict what will happen with genetically modified crops.'

Most Americans favor regulation for the use of genetic modification, but few have confidence in the government's ability to properly regulate.

- Three-quarters (75%) of respondents agree that the potential danger of genetic modification is so great that strict regulations are necessary.

- Slightly fewer than three in five respondents (58%) do not believe scientific expertise and knowledge concerning biotechnology is a substitute for government regulation.

- At the same time, less than one third of Americans (29%) believe the government has the necessary tools to properly regulate genetically modified foods.

Consistent with other surveys of this nature, nine out of ten Americans (90%) believe that genetically modified foods should be labeled as such.

- However, only about half of the consumers surveyed (53%) say they would actually take time to look for foods labeled as <u>not</u> being genetically modified.

- Less than half of respondents (45%) expressed a willingness to pay more for non-genetically modified foods.

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Acknowledgments

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Introduction

Biotechnology is a defining technology for the future of food and agriculture. Science and industry are poised to bring consumers a wide-variety of products that have potential for meeting basic food needs, as well as delivering a wide-range of health, environmental and economic benefits. Given this, it is imperative that we answer the following questions: *"What do we really know about how the public currently perceives biotechnology? And, how does this help to guide policy makers, regulators, consumers, farmers, food firms, and those in the biotechnology industry?*" If we were to rely on existing research, our unfortunate response for both questions would be *"not much*."

This answer should cause some concern because policy makers, regulators, consumers, farmers, food processors and distributors, as well as those in the biotechnology industry will make significant decisions in coming years that will define the direction of food biotechnology in the United States. The impact of such decisions will have economic, social, environmental and public health repercussions. These decisions will need to be based on rigorous scientific evidence examining potential risks, costs, and benefits to health, society, and the environment. However, because of the far reaching consequences it is also clear that decisions about biotechnology will necessarily be influenced by public opinion. As such, researchers must do more than develop a basic understanding of consumer opinions. They must systematically study the basis, the strength, the extent, and the persistence of consumers' attitudes. With this information we will be better able to understand the key influences on public opinion about food biotechnology.

There have been of course, a large number of publically and privately funded studies that have examined public opinions about food biotechnology. Yet, we still don't have a very comprehensive picture of what consumers think about genetically modified foods. When looking at the existing publicly-funded studies, it is difficult to compare results because they were typically conducted by different researchers at different times, in different countries, and with different objectives. In addition, most of the larger studies have tended to examine public awareness and attitudes toward biotechnology in the *abstract* rather than focusing on *specific* products or their characteristics. Such research typically asks consumers about the acceptability of biotechnology in general, rather than the acceptability of particular biotech products with specific characteristics. Ultimately, however, consumers must make individual purchasing

decisions about real products. In many respects, consumers will decide the fate of food biotechnology by voting with their dollars rather than voicing their opinions on a survey. Yet, most studies provide little insight into consumers' likely answers. Given the shortcomings in the available literature, it is often impossible to conclude how public opinion is *changing* over time, how opinions differ around the world, and what consumers might do when faced with the opportunity to purchase genetically modified foodstuffs.

Some smaller, proprietary industry studies have examined likely reactions to specific products. However, data is usually collected ad-hoc, focusing only on the acceptability of the characteristics of the particular product under design. As a result, the studies provide little comparative information that would allow the mapping of consumer preferences for products with alternative characteristics. Moreover, these studies are of varying quality, most are not peer reviewed, and few are available to academic researchers or other outside scrutiny.

Because of the limitations of the existing literature, much of what is known about public reactions to specific genetically modified foods comes from responses to a few particularly controversial products. Worldwide media attention has focused on recombinant bovine somatotropin (rBST), genetically modified soybeans, potatoes and corn. However, these are hardly representative of the large number of genetically modified products currently used in food, medicine, and manufacturing. These products include a growing list of enzymes, hormones, feedstock and other chemicals produced using genetically engineered organisms. As a result, the biotechnology and food industries, consumers, and policy makers are often left making decisions about future products based on generalized, incomplete, contradictory, and all-too-often, anecdotal evidence.

In sum, many of the existing studies lack specificity, availability, comparability, context, timeliness, balance and multi-disciplinary approaches. Consequently, the existing literature on public perceptions of biotechnology represents more of a collection of individual studies than an integrated body of knowledge. This study is the first in a series designed to address the deficiencies of the existing literature on consumer perceptions of agricultural biotechnology and to make this information available to the all interested parties.

Methodology

Questionnaire Development

The Food Policy Institute solicited input from more than fifty representatives in academia, food and agricultural companies, government, industry organizations and consumer groups to determine what should be asked of a national panel of consumers. These key stakeholders were interviewed to help generate a list of important topics, questions and issues of interest. These conversations allowed for a broader range of substance than appears in the existing literature. As such, this survey is well situated to address perceived gaps in the current literature on American consumer awareness, acceptance, and perceptions of food biotechnology. Additionally, this survey will serve as the basis for a set of longitudinal studies with the ability to track public opinion over time. The questionnaire was also designed to ensure direct comparability with several areas of inquiry incorporated into a 1993 survey of New Jersey residents (Hallman & Metcalfe, 1994) as well as with specific questions drawn from the 1999 Eurobarometer.[1]

Special attention was paid to both the wording and order of the questions in the survey. Previous studies have suggested that many Americans do not hold strong opinions about biotechnology. Where opinions are not strongly held, how one phrases a question can significantly impact the likely responses to that question. Similarly, the answers given to questions at the beginning of a survey may influence answers to questions asked later on. As such, readers should take note of the specific wording and order of questions in this survey (and any other) concerning public opinions about biotechnology. A copy of the questionnaire is provided in Appendix A.

Significant thought also went into the selection of the appropriate terminology used to describe the technology which is the subject of the questionnaire. The study team ultimately decided to use 'genetic modification' as the primary descriptor. The term 'genetic modification'

[1] The Eurobarometer (INRA Europe, 2000) is a broad-based public opinion poll managed by the public opinion analysis unit of the European Commission's Directorate-General for Education and Culture. The 1999 survey was administered to 16,082 people in 15 Member States (Belgium, Denmark, Germany, Greece, Spain, France, Ireland, Italy, Luxembourg, Netherlands, Austria, Portugal, Finland, Sweden, and United Kingdom). Of specific interest to this study is the Eurobarometer's focus on European knowledge, attitudes, and expectations of issues related to biotechnology.

is increasingly being used by a variety of organizations, and governmental institutions (especially in Europe) to specifically describe the application of recombinant DNA technologies to create new varieties of agricultural products. Indeed, the term 'genetically modified' is often shortened to its initials 'GM,' creating a new adjective used in conjunction with specific crops or products. Thus, it isn't unusual for people to refer to 'GM corn,' 'GM cotton,' 'GM soybeans,' or simply 'GM foods.' As a result, the designers of the cyclical Eurobarometer survey of European public attitudes toward biotechnology recently adopted the term 'genetic modification' or GM as the descriptor of recombinant DNA technology in its own surveys. To allow for comparisons between the beliefs and attitudes of the American and the European public, genetic modification was adopted as the term of choice for the current survey. However, the term biotechnology was also used in a few questions to maintain comparability with other surveys[2].

Sample Selection

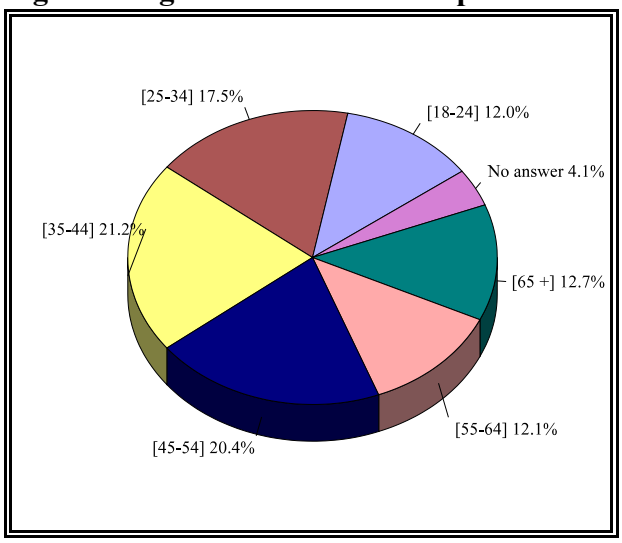
The targeted sample frame was the non-institutionalized United States adult (eighteen years and older) civilian population. The target sample of persons was selected using a random proportional probability sample drawn from the more than 97 million telephone households in the United States allowing a sampling error rate of ± 3%[3]. Each working telephone number was called

[2] Though the word 'biotechnology' actually encompasses a broad range of technologies, the terms biotechnology, genetic engineering, and genetic modification are all frequently used to describe the development of new hybrid organisms through recombinant DNA technologies. 'Biotechnology' was felt to be too broad a term to be used throughout the questionnaire. Some might suggest 'genetic engineering' as an appropriate substitute. However, that term has taken on a pejorative meaning and is most frequently used by the opponents of the technology.

[3] The percentages reported in this survey are estimates of what the distribution of responses would be if the entire adult population of the United States 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 nationwide sample of 1200 people is approximately ±3.0 percent at a 95 percent confidence interval. Thus, if 35 percent of those interviewed agree with a particular statement, the likely percentage of people in the United States who would agree would be between 32 percent and 38 percent (35 ± 3.0), 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 600 people, the sampling error is ±4.0 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.

a minimum of three times, at different times of the week, to reach people who were infrequently at home. Quotas were set up to ensure that representative numbers of males and females were interviewed. Random selection of which adult in the household was to be interviewed was accomplished by asking to interview the person aged 18 or over whose birthday had occurred most recently. The geographic coverage of the survey was commensurate with state populations estimates published by the U.S. Census Bureau.

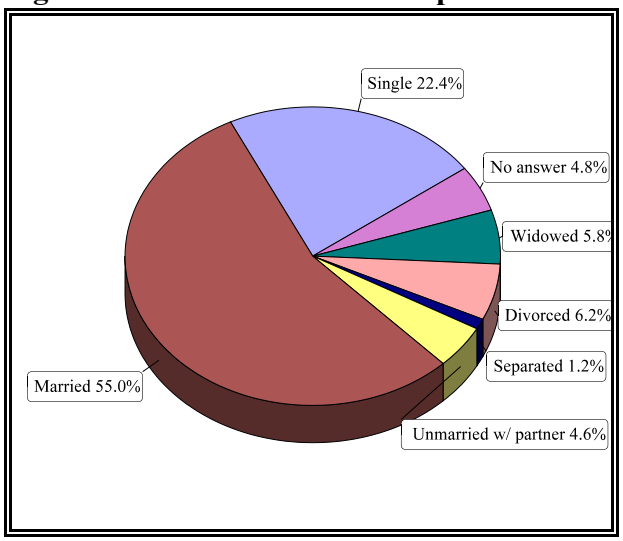
Figure 1: **Age Distribution of Respondents.**



Data Collection

Using a computer-assisted telephone interviews (CATI) system, a professional research firm[4] completed a total of 1203 phone surveys between March 15, and April 4, 2001. Over the course of the 21-day survey period, an average of 57 surveys was completed per day. A typical interview lasted 24.5 minutes.

Figure 2: Marital Status of Respondents.



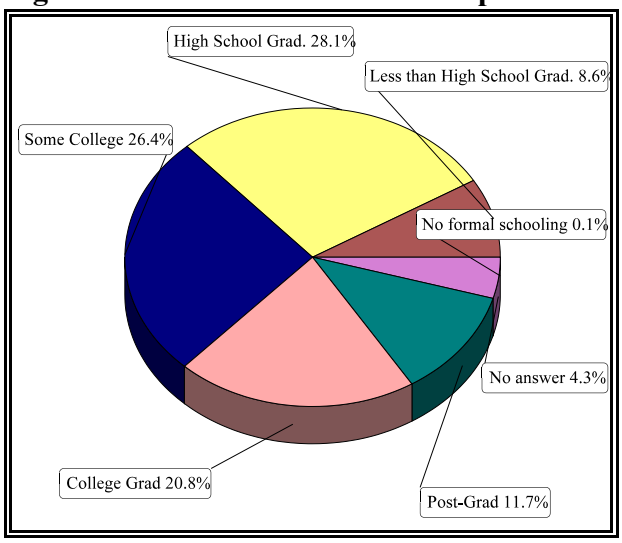
Sample Demographics

The sample size was 1203 respondents, 47 percent of whom are male. The age of the respondents ranged from eighteen to ninety-one, with a median age of forty-three years. The age distribution of respondents is provided in Figure 1.

[4] American Opinion Research (AOR), a division of Princeton, New Jersey based Integrated Marketing Services, was retained by the Food Policy Institute to administer the survey.

In response to standard U.S. Census racial categories, three-quarters of the respondents identified themselves as White, 9.5 percent as African-Americans, 1.6 percent as Asian or Pacific Islanders, 1.8 percent as Native Americans and 4.5 percent as 'other.'

Figure 3: Educational Level of Respondents.

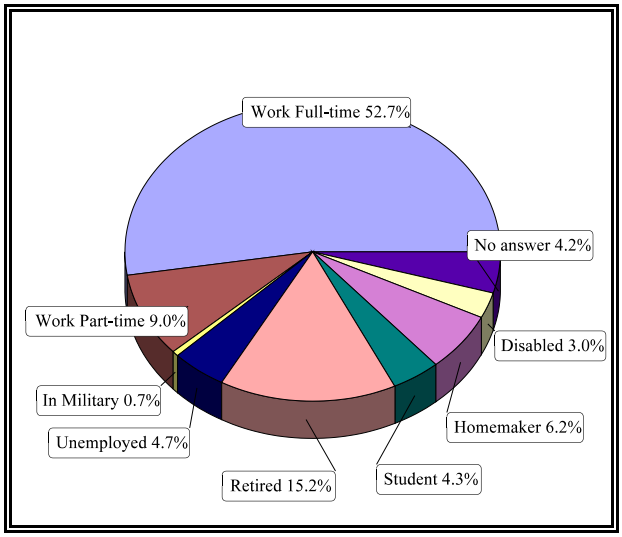


Slightly more than half (54.9 percent) of the individuals surveyed are married, while another 4.6 percent are unmarried but living with a partner (Figure 2). Nearly one-quarter (22.4 percent) of the respondents reported that they are single. Roughly 7.4 percent of the individuals surveyed are either separated or divorced, while 5.8 percent are widowed.

Approximately one out of every three (35.6 percent) respondents reported having at least one child under the age of seventeen living in the household.

Nearly 9 percent of the individuals surveyed reported that they had less than a high school education while 28.1 percent of the respondents had completed high school (Figure 3). An additional 26.4 percent reported having completed "some college" while 20.8 percent held a four-year college degree and 11.7 percent held postgraduate degrees.

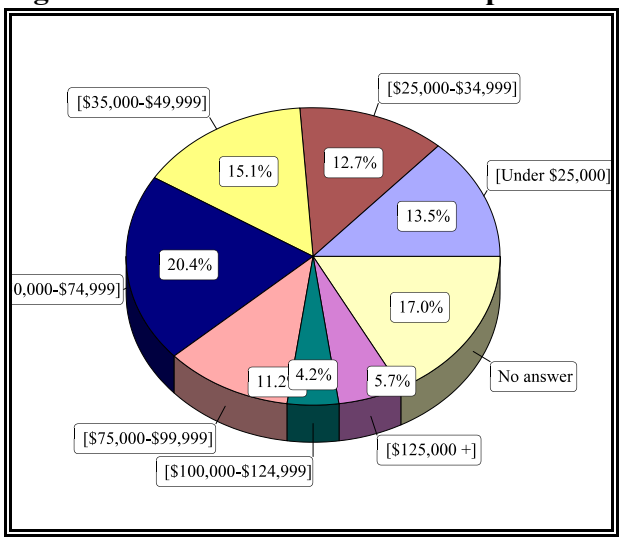
Figure 4: Employment Status of Respondents.



About half (52.8 percent) of the respondents said they are employed full-time and 9.0 percent maintain part-time employment (Figure 4). The remaining respondents are either retired (15.2 percent), homemakers (6.2 percent), unemployed (4.7 percent), students (4.3 percent), in the military (0.7 percent), or too disabled/ill to work (3.0 percent).

The distribution of total reported household income is provided in Figure 5. About 41 percent of the respondents report household incomes of less than $50,000. Roughly one-fifth of the households covered in the survey earn between $50,000 and $75,000. Nearly 10 percent of the respondents are in households earning $100,000 or more per year.

Figure 5: Household Income of Respondents.

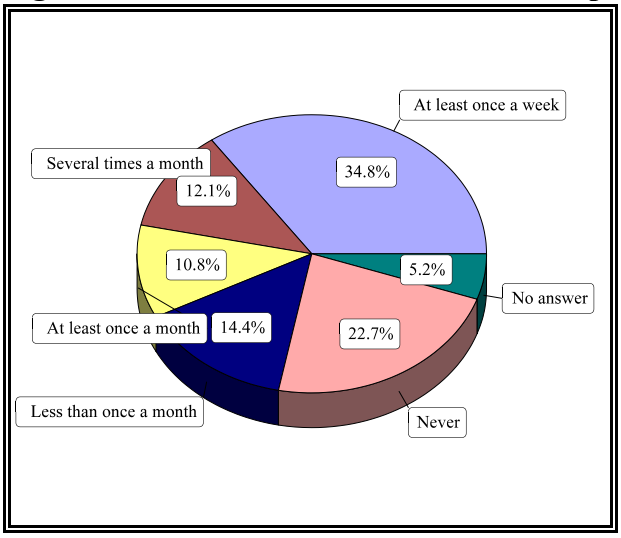


As a measure of religiosity, respondents were asked to indicate the frequency with which they attend a church or other house of worship. As shown in Figure 6, roughly three-quarters of those interviewed report attending a house of worship. More than one-third (34.8 percent) of the respondents attend a house of worship at least once a week.

Slightly more than six percent (6.3%) of the respondents report that they are members of or that they do work for an environmental group or organization. Further, 3.5 percent say they belong to or do work for a scientific group or organization, and 2.6 percent belong to or do work for a consumer group or organization.

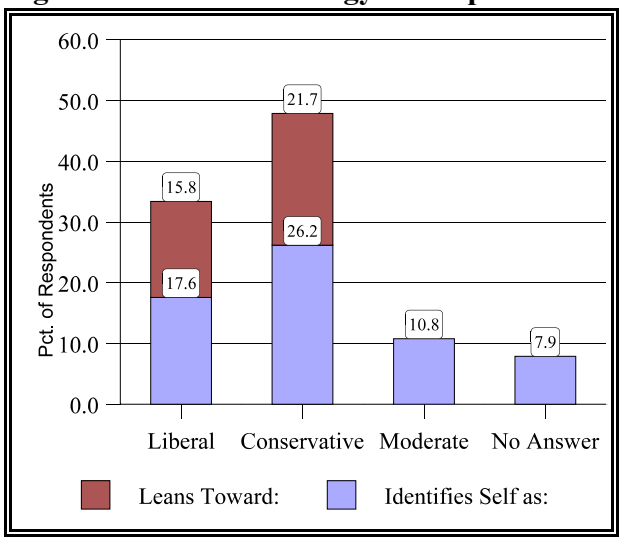
In terms of political ideology, about one-quarter (26.2 percent) of the respondents identify themselves as conservatives while another 21.7 percent report that they lean toward conservatism (Figure 7). Similarly, 17.6 percent of those surveyed identify themselves as liberals with another 15.8 percent report that they lean toward liberalism. Slightly more than 10 percent of survey respondents identify themselves as moderates.

Figure 6: Attendance at a House of Worship.



report that they lean toward conservatism (Figure 7). Similarly, 17.6 percent of those surveyed identify themselves as liberals with another 15.8 percent report that they lean toward liberalism. Slightly more than 10 percent of survey respondents identify themselves as moderates.

Figure 7: Political Ideology of Respondents.



Forty-four percent of those interviewed say that they do most of the food shopping for their households, while 35.9 percent say the responsibilities are equally divided. Not surprisingly, nearly two-thirds (63.0 percent) of the women interviewed say they do most of the shopping, while less than a quarter (22.8 percent) of the men interviewed say they have primary responsibility. Interestingly, within married couples, nearly half (47.9 percent) of the husbands interviewed say that responsibility for food shopping is equally divided while only a little more than a quarter (27.1 percent) of the wives interviewed see it the same way.

Data Weighting

Ideally, those who are interviewed in a survey have the same characteristics as the population they are meant to 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 who fall into specific demographic categories with the number of people one would expect to interview in those categories, based on Census figures for the United States. 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 country[5].

[5] For example, if census figures show that 39 percent of Americans 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.

In this study, the sample was weighted using comparison data from the 2000 Census. To better represent the population, the data was weighted to adjust for race, ethnicity, and education. As such, except for the reported sample demographics, all of the univariate results reported are estimates of the distribution of responses within the United States and so are derived from the weighted data. However, to avoid analytical errors caused by altering the variance and apparent degrees of freedom through the weighting process, the results of all inferential statistics reported are based on analyses using the unweighted data.

Results

Little Awareness of the Genetic Modification of Agricultural and Food Products

Food biotechnology is not an issue that seems to be on the agenda of most Americans. Consistent with other current surveys on consumer awareness of biotechnology (IFIC 2000; Gallup 2001), most Americans who responded to our survey say they have heard relatively little about these technologies. When asked how much they had heard or read about genetic modification, genetic engineering, or biotechnology, only 13 percent of the respondents indicated "a great deal" while 47 percent reported "some," 29 percent said "not much," and 11 percent said "nothing at all" (see Table 1). Men, and those people with more education report having heard more about biotechnology.

Table 1: Public Awareness of Food Biotechnology.

Q.13: Genetic modification 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 genetic engineering or biotechnology. How much have you heard or read about these methods?

	n	A Great Deal	Some	Not Much	Nothing at All	Not Sure
	1203[a]	13%	47%	29%	11%	<1%
Sex						
Male	567	14	51	26	9	0
Female	636	11	44	31	13	1
Age						
18-24	144	12	41	33	15	0
25-34	211	12	47	27	15	0
35-44	255	13	47	31	9	0
45-54	246	13	49	28	11	0
55-64	145	13	53	26	7	0
65+	153	13	49	27	9	3
Education						
< High School	104	8	40	31	20	1
High School Grad	338	8	39	37	15	<1
Some College	318	14	55	26	5	0
College Grad	250	18	56	22	3	1
Post Grad	141	27	58	13	2	0

(Percentages may not add to 100 due to rounding.)

[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.

Americans also freely admit to being relatively uninformed about biotechnology. Only about four in ten (41 percent) Americans agreed with the statement "I feel that I am adequately informed about biotechnology" (see Table 2). Similarly, when the International Food Information Council Foundation (IFIC 2000) study asked Americans how well informed they were about biotechnology on a scale ranging from zero (not at all informed) to ten (very well informed), the median score was three. Internationally, more than four-fifths of Europeans disagreed with the statement "I feel that I am adequately informed on biotechnology" when it was presented to them in the 1999 Eurobarometer.

Table 2: Feelings of Being Informed About Biotechnology.

Q.30q: I feel I am adequately informed about biotechnology.

	n	Totally Agree	Mostly Agree	Mostly Disagree	Totally Disagree	Not Sure
	1203[a]	14%	27%	33%	24%	2%
Sex						
Male	567	13	31	33	21	2
Female	636	14	24	33	26	3
Age						
18-24	144	20	32	34	14	0
25-34	211	6	36	32	23	3
35-44	255	14	26	33	25	2
45-54	246	14	23	35	27	2
55-64	145	7	25	38	30	0
65+	153	22	22	27	24	5
Education						
< High School	104	19	30	23	24	3
High School Grad	338	13	23	32	30	2
Some College	318	12	29	37	22	1
College Grad	250	11	30	36	22	1
Post Grad	141	17	29	42	11	2

(Percentages may not add to 100 due to rounding.)

[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.

Biotechnology is Not a Topic of Conversation for Most Americans

The finding that Americans are not well informed about biotechnology is also reflected in the fact that fewer than one-third of Americans (31%) say that they have ever discussed the topic with anyone. A slightly greater proportion of men (35%) than women (28%) report having had a conversation about biotechnology. Not surprisingly, those with more education were also more likely to report having had a conversation about biotechnology. Fifty-six percent of those with a postgraduate education, 44 percent of college graduates, and 37 percent of those with

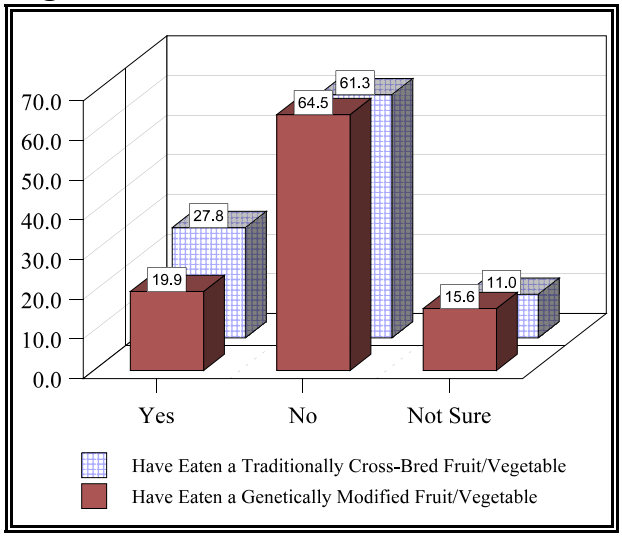
some college report having had such a conversation. In contrast, only 24 percent of high school graduates and 17 percent of those with less than a high school education said that they had talked with someone else about biotechnology. Interestingly, those who work in the food industry were no more likely to report having had a conversation about biotechnology than those in the general population. Only 29 percent of those who say that their jobs involve growing or processing food and 29 percent of those who say their jobs involve preparing or selling food reported ever having had a conversation about biotechnology. In contrast, 54 percent of those who identified themselves as scientists or engineers and 38 percent of those in the medical professions reported talking with someone else about biotechnology.

Of the 31% of Americans who have ever discussed the issue of biotechnology, one-third (36 percent) say that they have talked about it with others only "once or twice." As such, only 20 percent of Americans say that they have ever had more than one or two discussions about biotechnology with anyone else. Clearly, biotechnology is not a frequent topic of conversation for most Americans.

What is on the Supermarket Shelf?

This lack of awareness of biotechnology appears to translate directly into a general lack of recognition of food biotechnology on supermarket shelves. Despite the abundance of products with genetically modified ingredients in the market today, only two-in-five Americans (41 percent) are aware that genetically modified food products are currently for sale in supermarkets. A third of Americans (32 percent) do not believe such products are in food stores, while another quarter (28 percent) are not sure. In contrast, while there are few genetically modified fruits and vegetables currently available in the marketplace, one-in-five Americans (20 percent) believe that they have already eaten a fruit or vegetable created using biotechnology (Figure

Figure 8: Reported Consumption of Traditionally Crossbred and GM Fruits and Vegetables.



8). A little less than two-thirds (65 percent) specifically indicated that they had not eaten a genetically modified fruit or vegetable while 16 percent were not sure.

But What Do Americans Really Know About Food Biotechnology?

Self-Rated Knowledge of Food Production

Americans tend to believe that they are generally well informed about the process of food production in the United States. When asked to rate their basic understanding of how food is grown and produced, three-quarters of the respondents (75 percent) indicate that their knowledge is at least "good" (Table 3). Women and respondents with higher levels of education tend to report the highest levels of understanding.

Table 3: Assessment of Knowledge of Food Production.

Q.1: Would you rate your own basic understanding of how food is grown and produced as excellent, very good, good, fair, or poor?

	n	Excellent	Very Good	Good	Fair	Poor	Not sure
	1203[a]	11%	21%	43%	19%	5%	1%
Sex							
Male	567	11	23	40	20	5	1
Female	636	12	20	45	17	5	1
Age							
18-24	144	4	8	52	26	7	2
25-34	211	7	24	49	15	5	1
35-44	255	9	26	35	24	4	1
45-54	246	16	22	39	17	5	1
55-64	145	16	26	42	14	3	1
65+	153	15	20	43	15	7	0
Education							
< High School	104	7	21	40	24	6	3
High School Grad	338	9	20	45	18	7	1
Some College	318	12	19	47	19	3	0
College Grad	250	17	25	40	15	4	0
Post Grad	141	18	28	36	12	4	2

(Percentages may not add to 100 due to rounding.)

[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.

However, Americans' knowledge of food production appears to be overestimated. For example, half of those interviewed said that they had never heard about traditional crossbreeding methods even when those methods were described in simple terms. In addition, despite the fact that nearly all foods currently available are the result of traditional crossbreeding techniques, 61 percent of the respondents said that they had never eaten a fruit or vegetable created using these methods (another 11 percent indicated that they were not sure).

Many Americans also seem to have a fairly romantic view of farming. For example, 57 percent of the respondents believe that most farmers would prefer to farm organically rather than use chemical pesticides and fertilizers. Moreover, nearly 47 percent of Americans incorrectly believe that most food produced in the U.S. is grown on family farms.

Self-Rated Understanding of Science and Technology

Americans are generally less optimistic about their understanding of science and technology. Only two-thirds rate their basic understanding as "good" or better (Table 4). Men, younger respondents, and those with greater levels of education rate their level of knowledge about science and technology highest. Interestingly, there was only a moderate correlation between the respondent's ratings of their understanding of science and technology and their self-rated understanding of food production ($r_{(1192)}$=.33, $\underline{p}$<.001).

Table 4: Assessment of Knowledge of Science and Technology.

Q.2: Would you rate your own basic understanding of science and technology as excellent, very good, good, fair, or poor?

	n	Excellent	Very Good	Good	Fair	Poor	Not sure
	1203[a]	8%	18%	40%	25%	7%	2%
Sex							
Male	567	10	23	39	23	4	1
Female	636	6	14	41	27	9	3
Age							
18-24	144	10	20	41	24	5	1
25-34	211	12	17	41	25	4	1
35-44	255	7	18	40	28	5	1
45-54	246	5	20	40	26	6	3
55-64	145	7	24	35	22	9	3
65+	153	5	11	43	24	13	4
Education							
< High School	104	10	14	34	22	13	6
High School Grad	338	5	14	41	33	6	2
Some College	318	7	18	44	26	6	0
College Grad	250	10	32	37	18	3	1
Post Grad	141	16	24	43	13	1	4

(Percentages may not add to 100 due to rounding.)

[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.

Biotechnology Quiz

To gauge actual understanding of science and technology with respect to genetics and genetic modification, the survey respondents were presented with a nine-question "biotechnology quiz" to assess basic knowledge of biological facts and principles. Despite the fact that 66 percent of Americans reported that their knowledge of science and technology was at least "good," the quiz results suggest otherwise. As shown in Table 5:

- 34 percent of Americans incorrectly believe that "genetically modified foods are created using radiation to create genetic mutations" (another 20 percent were not sure if this statement was true or false).
- 33 percent of Americans incorrectly believe that "it is impossible to transfer animal genes to plants" (another 16 percent were not sure if this statement was true or false).

- 24 percent of Americans incorrectly believe that "ordinary tomatoes do not contain genes, while genetically modified tomatoes do" (another 19 percent were not sure if this statement was true or false).

- 30 percent of Americans incorrectly believe that "genetically modified animals are always larger than ordinary animals" (another 11 percent were not sure if this statement was true or false).

- 27 percent of Americans failed to agree with the statement "the father's genes determine whether the child is a girl" (another 9 percent were not sure if this statement was true or false).

- 22 percent of Americans incorrectly believe that "tomatoes genetically modified with genes from catfish would probably taste 'fishy'" (another 10 percent were not sure if this statement was true or false).

- 21 percent of Americans incorrectly believe that "if a person eats a genetically modified fruit, their genes could be modified as a result" (another 11 percent were not sure if this statement was true or false).

- 19 percent of Americans failed to agree with the statement "the yeast used to make beer contains living organisms" (another 11 percent were not sure if this statement was true or false).

- 4 percent of Americans failed to agree with the statement "there are some bacteria which live on waste water" (another 2 percent were not sure if this statement was true or false).

Seven of the nine questions in the quiz were also asked as part of the 1999 Eurobarometer survey of consumers' attitudes toward biotechnology in the European Union (INRA Europe, 2000). The comparative results (shown in Table 5) suggest that American consumers may be more knowledgeable about some basic facts related to food biotechnology than their European counterparts. This is especially true with regard to the five questions related to genetics. In each case, between half and two-thirds of Americans gave the correct answer, while only one-quarter to a little less than one-half of all Europeans answered correctly.

Table 5: Biotechnology Quiz Results.

	U.S. Results (2001)			*EU Results (1999)*		
Question	**True (%)**	**False (%)**	**Don't Know (%)**	**True (%)**	**False (%)**	**Don't Know (%)**
There are some bacteria which live on waste water. (True)	94	4	2	83	4	13
Ordinary tomatoes do not contain genes, while genetically modified tomatoes do. (False)	24	57	19	35	35	30
If a person eats a genetically modified fruit, their genes could be modified as a result. (False)	21	68	11	24	42	34
The father's genes determine whether the child is a girl. (True)	64	27	9	44	29	26
The yeast used to make beer contains living organisms. (True)	70	19	11	66	12	23
Genetically modified animals are always larger than ordinary animals. (False)	30	59	11	28	34	38
It is impossible to transfer animal genes into plants. (False)	33	51	16	27	26	47
Tomatoes genetically modified with genes from catfish would probably taste "fishy." (False)	22	67	10	Not asked in Eurobarometer.		
Genetically modified foods are created using radiation to create genetic mutations. (False)	34	46	20	Not asked in Eurobarometer.		

* Correct responses are shaded.

Still, while Americans may know somewhat more about genetics that European consumers, there is little cause for boasting. As shown in Table 6, most Americans would have failed the quiz. Only two-in-five Americans (40 percent) correctly answered more than 6 questions. Moreover, self-ratings of their understanding of food production and science and technology were both poor predictors of the respondents' scores on the quiz. Though reaching statistical significance at the $p < .01$ level, the correlation between self-rated understanding of food production and the respondent's quiz score was .09 and the correlation between self-rated understanding of science and technology and the respondent's quiz score was .18 respectively. Men, younger people, and those with more education tended to have higher scores on the quiz.

Table 6: Summary of Performance on Biotechnology Quiz.

	Number of Correct Answers								
	n	0	1-2	3-4	5-6	7-8	9	Mean	Median
	1203[a]	<1%	5%	23%	32%	33%	7%	6.0	6
Sex									
Male	567	<1	4	20	30	39	8	6.2	7
Female	636	<1	6	25	34	29	6	5.8	6
Age									
18-24	144	0	3	28	28	32	9	6.1	6
25-34	211	1	1	20	30	41	8	6.3	7
35-44	255	0	5	15	31	42	7	6.4	7
45-54	246	0	7	19	34	33	7	6.0	6
55-64	145	0	4	29	33	31	4	5.7	6
65+	153	1	11	31	37	16	4	5.0	5
Education									
< High School	104	0	9	31	40	18	3	5.1	5
High School Grad	338	1	6	29	36	25	4	5.3	5
Some College	318	0	3	20	27	41	8	6.2	7
College Grad	250	0	3	10	25	51	11	6.6	7
Post Grad	141	1	4	6	24	49	17	6.8	7

(Percentages may not add to 100 due to rounding.)

[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 Biotechnology, Genetic Engineering, and Genetic Modification

It is clear that most Americans don't know very much about biotechnology, yet they still seem to have opinions about it. So, what are their impressions of the technology? Using a word-association task, the survey participants were asked to report the first thought or image that came to mind in response to the terms biotechnology, genetic engineering, or genetic modification. The sample was randomly split into thirds, so that each person surveyed only responded to one of the terms, and of course, none of the terms had yet been mentioned in the survey. The responses were recorded verbatim and initially coded into 49 categories (see Appendix B) and then into one of 11 main classifications (see Table 7).

Table 7: First Thought or Image Related to Biotechnology, Genetic Engineering, or Genetic Modification.

Q12. When you think about _____, what is the first thought or image that comes to mind?

Category of First Thought or Image	Biotechnology %	Genetic Engineering %	Genetic Modification %	Total %
No Answer	26	17	22	22
Negative	10	21	25	19
Positive	13	5	8	9
Science	22	18	9	16
Cloning	5	16	14	12
Sheep	1	4	6	4
Other Animals	1	3	3	2
People	<1	3	2	2
Plants	7	2	3	4
Science Fiction	4	1	1	2
Changing Things	1	1	2	2
Business/Stocks	2	2	1	1
Others	8	6	3	6

(Percentages may not add to 100 due to rounding.)

[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.

The results suggest that, consistent with their reported unfamiliarity with the subject, many Americans have no real first thought or image that they associate with the terms biotechnology, genetic engineering or genetic modification. Interestingly, the term biotechnology evokes the fewest associations, with more than one-in-four respondents (26 percent) failing to report a first thought or image, even after additional prompting. About one-in-five respondents (22 percent) were unable to produce a first thought or image in response to the term genetic modification, and one-in-six (17 percent) were unable to do so with regard to the term genetic engineering.

The term genetic modification yielded the most negative associations, with one-in-four respondents (25 percent) bringing to mind images of Frankenstein, test-tube babies, mutants or monsters, or responding with words like yuck, disgusting, fake, evil, tampering, danger, and wrong. The term genetic engineering evoked similar responses in one-in-five respondents (21 percent), while only 10 percent of those had similar negative associations with the term

biotechnology. In contrast, the term biotechnology lead to the most positive associations, with 13 percent reporting images of new medicines or foods or responding with words like better, progress, improved, future, modern, or approve. Only 8 percent had similar responses to the term genetic modification and only 5 percent had positive associations with the term genetic engineering (See Appendix B).

The term biotechnology led to the most associations with science with 22 percent reporting images of test-tubes, or laboratories, DNA or chemicals, or the words science, technology or biology. Eighteen percent reported similar associations in response to the term genetic engineering, but only 9 percent thought of science in connection with the term genetic modification.

Interestingly, though biotechnology is the broadest term and includes both recombinant DNA and cloning technologies, only 6 percent of the respondents associated cloning (or sheep[6]) with biotechnology. Conversely, 20 percent associated cloning (or sheep) with genetic engineering and 20 percent connected cloning (or sheep) with genetic modification, though these terms only refer to recombinant DNA technology.

Clearly, the three terms evoke different images for Americans. The word biotechnology seems to evoke the most positive and least negative images for people, with many people associating the term with science and plants. On the other hand, the terms genetic modification and genetic engineering are seen as more negative, and are most associated with cloning. As such, for people who are relatively unfamiliar with the technology, it may make a difference what you call it.

Public Acceptance of Food Biotechnology

Overall, the American public's position on the acceptability of genetic modification of food is decidedly . . . undecided. The data suggests that most Americans have not yet made up their minds about the issue. Yet, some familiar patterns emerge from the survey data. Consistent with prior surveys, Americans express greater support for the genetic modification of

[6] It is assumed that the images of sheep mentioned are connected with cloning. Many respondents referred specifically to 'Dolly' the first sheep that was successfully cloned, others referred to her as 'Polly,' 'Molly,' "Golly," or other rhyming names. Some simply referred to lambs or sheep. Only two percent of the respondents reported thoughts or images of any other animals.

plants than they do for animals. When asked directly, the majority of Americans either strongly approve (16 percent) or somewhat approve (42 percent) of creating hybrid plants via genetic modification, whereas 37 percent disapprove (almost 6 percent were not sure) (see Table 8). About one-fifth (22 percent) believe that creating hybrid plants through genetic modification is morally wrong. The majority (70 percent) of Americans, however, do not view such practices as morally objectionable. The remaining 8 percent are unsure or say that the moral status of genetic modification depends on the circumstances.

Table 8: Consumer Acceptance of Plant-Based Genetic Modification.

Q.19: In general, do you approve or disapprove of creating hybrid plants using genetic modification?

	n	Strongly Approve	Somewhat Approve	Somewhat Disapprove	Strongly Disapprove	Not Sure
	1203[a]	16%	42%	19%	18%	6%
Sex						
Male	567	21	43	16	16	4
Female	636	12	41	21	19	7
Age						
18-24	144	15	50	20	13	2
25-34	211	18	43	14	21	5
35-44	255	18	41	19	18	4
45-54	246	16	37	24	16	6
55-64	145	15	38	17	19	11
65+	153	14	43	19	19	6
Education						
< High School	104	19	36	21	19	5
High School Grad	338	12	38	22	22	6
Some College	318	17	48	17	14	4
College Grad	250	17	46	16	13	8
Post Grad	141	25	42	15	14	5
"Quiz Score"						
0 to 3		7	24	23	37	10
4 to 6		13	44	19	19	6
7 to 9		23	46	18	10	4

(Percentages may not add to 100 due to rounding.)

[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.

When asked about the genetic modification of animals, the American public appears far less receptive to the use of such techniques (Table 9). Only 28 percent of the respondents

approve of such practices. In contrast, more than two-thirds of the population disapproves of the genetic modification of animals (43 percent disapprove strongly and 25 disapprove somewhat). A much greater percentage of Americans (55 percent) also view this application of biotechnology as morally wrong (another 4 percent indicated that the morality of animal genetic modification depends on the specific circumstances and another 4 percent were unsure).

Table 9: Consumer Acceptance of Animal-Based Genetic Modification.

Q.21: In general, do you approve or disapprove of creating hybrid <u>animals</u> using genetic modification?

	n	Strongly Approve	Somewhat Approve	Somewhat Disapprove	Strongly Disapprove	Not Sure
	1203[a]	7%	21%	25%	43%	5%
Sex						
Male	567	10	26	24	35	5
Female	636	5	16	25	49	4
Age						
18-24	144	8	28	30	32	2
25-34	211	7	21	24	43	4
35-44	255	6	23	24	42	5
45-54	246	8	16	25	46	6
55-64	145	7	17	19	53	4
65+	153	5	18	26	43	8
Education						
< High School	104	8	19	26	42	4
High School Grad	338	5	18	24	51	3
Some College	318	7	20	27	39	6
College Grad	250	5	28	21	39	7
Post-Grad	141	18	22	24	32	4
"Quiz Score"						
0 to 3		4	13	17	59	7
4 to 6		6	16	26	47	5
7 to 9		10	29	26	32	4

(Percentages may not add to 100 due to rounding.)

[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.

In general, men appear to be more approving of genetic modification than women. Younger and better educated persons also report higher levels of approval. In addition, as shown in Table 10, individuals who reported having heard or read about genetic modification before the survey were more approving of its use. Sixty-two percent of those who had heard or read about genetic

modification approved of its use to create hybrid plants. Only 52 percent of those that had not heard or read about genetic modification approved of the application of the technology to create new plants. A similar pattern was evident in the case of animal genetic modification. Those who had heard of genetic modification before the survey were also less likely to be morally opposed to the technology. A similar association was found between knowledge of genetics and biotechnology (as measured via the quiz score) and approval. Respondents able to answer more questions correctly tended to have higher levels of approval for the genetic modification of plants ($r_{(1192)}$=.25, $\underline{p}$<.01) and animals ($r_{(1192)}$=.21, $\underline{p}$<.01).

Table 10: Influence of Prior Knowledge of Genetic Modification on Approval Ratings.

		Creating Hybrid Plants Through GM			***Creating Hybrid Animals Through GM***		
	n	Approve	Disapprove	Not Sure	Approve	Disapprove	Not Sure
	1203	57.8%	36.7%	5.5%	27.7%	67.6%	4.6%
How much have you							
'*A Great Deal*' or '*Some*'	770	61.7	35.2	3.0	31.7	65.3	3.0
'*Not Much*' or '*Nothing at All*'	433	51.7	39.2	9.0	22.0	71.2	6.6

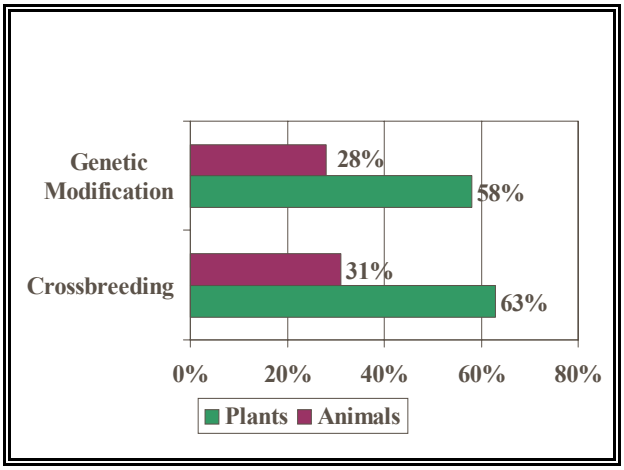
Consumer Approval for Traditional Crossbreeding Methods

As a point of reference, public acceptance of traditional crossbreeding techniques was also evaluated. Of course, traditional crossbreeding techniques have been used for thousands of years to improve agricultural products. Yet, as previously noted, half of those interviewed said that they had not heard of traditional crossbreeding when it was described to them in simple terms. This unfamiliarity is reflected in the fact that the hybridization of plants via traditional crossbreeding is viewed as acceptable by only 63 percent of Americans (Figure 9) and that nearly 19 percent of the public believes these techniques to be morally objectionable. Slightly less than one-third (31 percent) of Americans say they approve of creating hybrid animals through traditional crossbreeding and half believe that using such techniques with regard to animals is morally wrong. It is important

to point out that the approval ratings for the hybridization of plants and animals through genetic modification and through more traditional crossbreeding methods are quite similar (see Figure 9).

One may view these findings with a degree of surprise given the long history and broad extent of use of traditional crossbreeding methods. While persons reporting a greater level of understanding of science and technology were significantly more likely to have heard about traditional crossbreeding methods, it is also likely that many Americans who learned about traditional crossbreeding methods in school have had little occasion to think about them post- graduation. Respondents who felt that they had a good understanding of how food is grown and produced were also somewhat more likely to have heard of crossbreeding methods. Respondents who had heard of traditional crossbreeding were found to be more approving of, and less morally opposed to, these methods than persons who said that they had not heard of these techniques. Still, it is important to point out that many Americans seem to have a difficult time differentiating between hybridization of plants and animals through genetic modification through biotechnology and through more traditional crossbreeding methods.

Figure 9: Approval of Traditional Crossbreeding and Genetic Modification Methods to Create Hybrid Plants and Animals



Consistency is the Hobgoblin . . .

Most Americans have not thought very much about the issues surrounding agricultural biotechnology, so their opinions regarding food biotechnology are still relatively uncrystallized. As such, the opinions that many Americans express about genetic modification tend not to be strongly held, are subject to change, and may be strongly influenced by how a question is asked. For example, responses to questions concerning the same issue asked in slightly different ways may yield inconsistent answers.

At this point, public approval of genetic modification seems to be mixed. Fifty-eight percent of Americans approve of creating hybrid plants using genetic modification, and 28

percent approve of creating hybrid animals using such methods. Yet, nearly 60 percent of Americans feel that such technologies will make the quality of their lives better. Only 26 percent think that these methods would make the quality of life worse for persons similar to them, while another 15 percent are uncertain as to how genetic modification would affect their lives.

Furthermore, 61 percent agree that "unjustified fears about genetic modification have seriously blocked the development of beneficial foods" and 62 percent believe that genetically modified foods will benefit many people. Yet, almost half (45 percent) of Americans feel that genetically modified food is simply not necessary, and more than one-third (35 percent) of Americans agree that "it would be better if we did not know how to do genetic modification at all."

Specific Products, Not Abstract Concepts

For most Americans, genetic modification is still an unfamiliar and rather abstract concept, lacking any real context. As such, people's reactions to questions about the technology tend to be somewhat negative. On the other hand, people's responses to questions concerning the use of genetic modification to create real products with beneficial characteristics tend to be quite positive.

As shown in Figure 10, when presented with specific application of genetic modification, public approval tends to rise considerably. For example, while only 58 percent of Americans say that, in the abstract, they approve of the use of genetic modification to create new kinds of plants, 85 percent say that they would approve of the use of genetic modification to create more nutritious grain that could feed people in poor countries. Eighty percent also say that they would approve of the use of genetic modification to create rice with enhanced Vitamin A to prevent blindness.

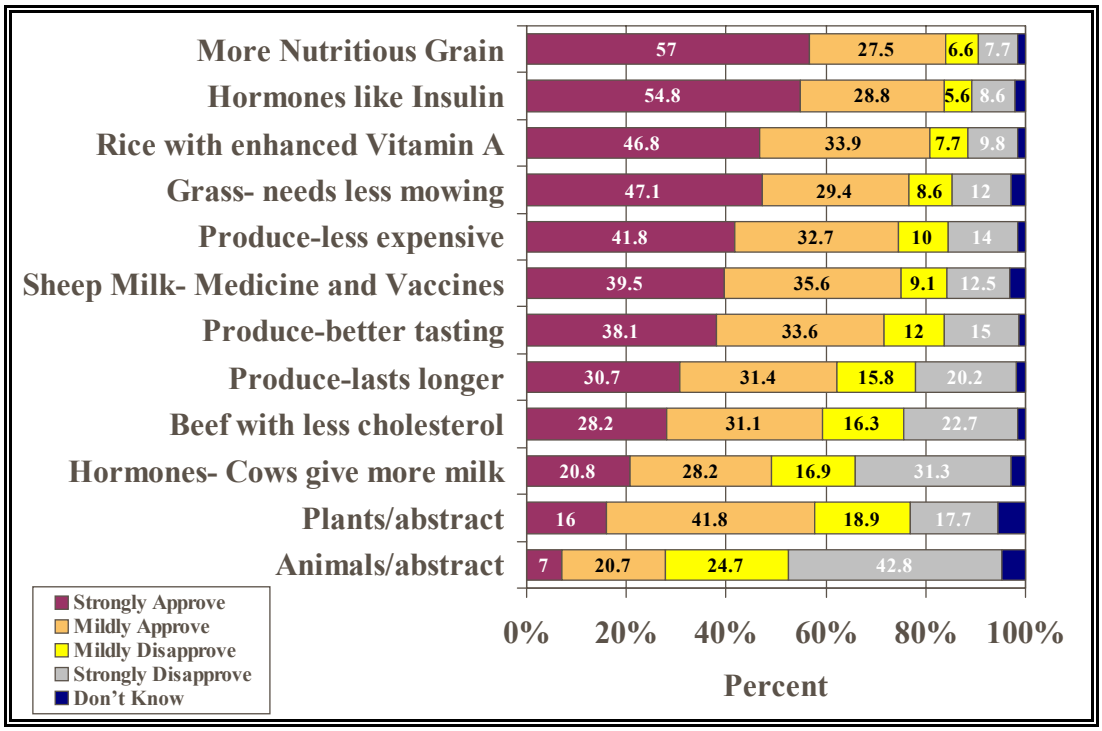
Similarly, in the abstract, only 28% of Americans say that they approve of the use of genetic modification to create hybrid animals. Yet, more than three-quarters of the public (76 percent) say they would approve of the use of genetic modification techniques to create sheep whose milk can be used to produce medicines and vaccines. An even greater number (84 percent) say they would approve of the use of genetic modification to create hormones like insulin to help diabetics.

In general, genetically modified products that confer some form of health benefit to the consumer (e.g., treatment for diabetes, vitamin A enhanced rice, more nutritious grain to feed people in poor countries, etc.) tended to receive the highest approval ratings. Yet, people don't restrict their approval to GM products with purely altruistic benefits. Nearly three-quarters of those surveyed (74 percent) say that they would also approve of the use of genetic modification to create less expensive or better tasting produce, and more than three-quarters (76 percent) say that they would approve of genetically modified grass that you don't have to mow so often." What these findings suggest is that people may be willing to consider the characteristics of the products of biotechnology rather than deciding that all biotechnology is good or bad.

What Concerns Americans About Genetic Modification of Foods?

While most Americans say they would be in favor of at least some genetically modified food products, and nearly two-thirds believe that genetically modified foods will benefit many people, more than half (56 percent) say that the issue of genetic modification causes them great

Figure 10: Approval of the Use of Genetic Modification to Create Products with Beneficial Characteristics.



concern (Table 11), and many are concerned that genetic modification may pose a possible threat to future generations. In fact, four-out-of-five Americans agree with the idea that serious accidents involving genetically modified foods are bound to happen due to human error. In addition, about half of the public also feels that if something went wrong with genetically modified food it would be a "global disaster." In fact, nearly three-quarters (74 percent) agree that the potential danger from genetic modification is so great that strict regulations are necessary.

Table 11: Public Perceptions of the Risk of Genetically Modified Foods.

	n=1203[a]	Totally Agree	Mostly Agree	Mostly Disagree	Totally Disagree	Not Sure
If something went wrong with genetically modified food, it would be a global disaster		23	26	29	15	7
The idea of genetically modified food causes me great concern		27	29	25	16	2
Whatever the risks involved in genetically modified food, we can avoid them if we really want to		29	37	17	11	5
The risks involved in genetically modified food are acceptable		11	29	27	25	7
Genetically modified food presents no danger for future generations		10	23	32	23	11

(Percentages may not add to 100 due to rounding.)

[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.

Though many Americans appear to be concerned about the potential risks of food biotechnology, only about a third (35 percent) of the public believes that "it would be better if we did not know how to do genetic modification at all." An almost identical percentage (32 percent) said they would sign a petition against biotechnology.

On the other hand, the majority (58 percent) of Americans agree that "the risks

associated with genetic modification have been greatly exaggerated," and nearly two-thirds agree that "unjustified fears about genetic modification are blocking the development of beneficial foods." Moreover, 62 percent also agree that "if the majority of people were in favor of genetically modified food, it should be permitted."

When one delves more deeply into the concerns the American public has about genetic modification, several recurring themes emerge. These concerns tend to revolve around possible human health impacts, potential environmental impacts, and the perceived consequences of 'meddling with nature.' Issues relating to the public's confidence in, and trust of, regulators and scientists are also important factors influencing consumer views and acceptance of food biotechnology (Hallman, 2000).

Concerns About the Ecological Consequences of Agricultural Biotechnology

A particular focus of this study is public perceptions of the ecological consequences of agricultural biotechnology. Potential ecological disruption due to the release and proliferation of genetically modified plants or animals in the natural environment is often cited as a major point of opposition to biotechnology. Yet, there has been little work that examines American consumer perceptions of the potential threat posed by agricultural biotechnology.

One of the key arguments made by groups opposed to agricultural biotechnology is that genetically modified crops are not natural and that they risk upsetting a fragile 'balance of nature.' The results of this study suggest that this is an argument that might find a ready audience among American consumers. For example:

- Nine out-of-ten agree that "the balance of nature can be easily disrupted by humans".
- Nearly three-quarters (74 percent) feel that "nature is so complex that it is impossible to predict what will happen with genetically modified crops".
- 58 percent feel that "we have no business meddling with nature".
- 54 percent feel that "even if genetically modified food has advantages, it is basically against nature".
- And more than half (53 percent) believe that "genetically modified food threatens the natural order of things."

Who Should Keep an Eye on Things?

Factoring prominently into the debate over consumer acceptance or opposition to genetically modified foods is the public's faith (or lack thereof) that the food biotechnology industry, the scientific community, and/or government regulators will protect them from unsafe products. As noted previously, 74 percent of Americans believe that strict regulation of genetic modification is needed. However, most respondents clearly exhibit skepticism that either companies engaged in food biotechnology or the scientific community are motivated or capable enough to protect the public from potentially adverse impacts of genetic modification.

For example, the majority (about 58 percent) of the public does not believe that the expertise and knowledge of scientists are a sufficient replacement for regulation of genetic modification. Moreover, nearly three-quarters (73 percent) think that "most genetically modified foods were created by scientists because they were able to make them, and not because the public necessarily wanted them." In addition, more than two-thirds of Americans feel that companies involved in the creation of genetically modified foods are more concerned with profits than safety.

The public staunchly believes in the need for such regulation and does not feel that such oversight can be industry-driven. Yet, Americans also place little faith in the ability of the government to regulate food biotechnology. Less than one-third of the public believes that the government has the necessary tools to properly regulate genetically modified foods. Perhaps even more fundamental, however, is the fact that only about 40 percent of Americans actually feel that government regulators have the best interests of the public in mind. So it seems that the American public wants regulation of food biotechnology but has little faith in the ability of scientists, industry, or government to properly perform this task.

While most Americans seem to know very little about the science of genetic modification, they are reluctant to relinquish their involvement in decisions regarding such technologies. For example, only one-quarter of the respondents agreed with the following statement: "decisions about the issue of genetically modified food are so complicated that it is a waste of time to consult the public on this subject." Seven of ten respondents disagreed with the statement (28 percent "mostly" disagreed while 42 percent "totally" disagreed). Apparently, 'leaving it to the experts' is not a very palatable option.

Consumers Want the Right-to-Know

Americans feel strongly regarding their right to know about the use of genetic modification in the production of foods they consume. Consistent with past surveys on food biotechnology, the vast majority (90 percent) believe that foods created through genetic modification should have special labels. Only 9 percent of those interviewed did not see the need for special labels on genetically modified foods (1 percent were not sure). Despite the demand for such notification, only 53 percent of those surveyed indicated that they would actually take the time to look for fruits and vegetables labeled as not being genetically modified. Interestingly, if fresh vegetables were labeled as having been produced using genetic modification, only 48 percent of the respondents said they would be less likely to purchase them while 37 percent indicated that such labeling would not make any difference in their purchase decision. Roughly one-in-ten (11 percent) said they would be more likely to buy the products while 4 percent were not sure what impact labeling would have on their purchase decision. Less than half of Americans (45 percent) expressed a willingness to pay more for non-genetically modified foods. In terms of strength of conviction, it appears that most Americans would prefer to know about presence of genetically modified ingredients in their foods. However, most people do not appear willing to expend additional time or money to ensure that such products do not enter their diet.

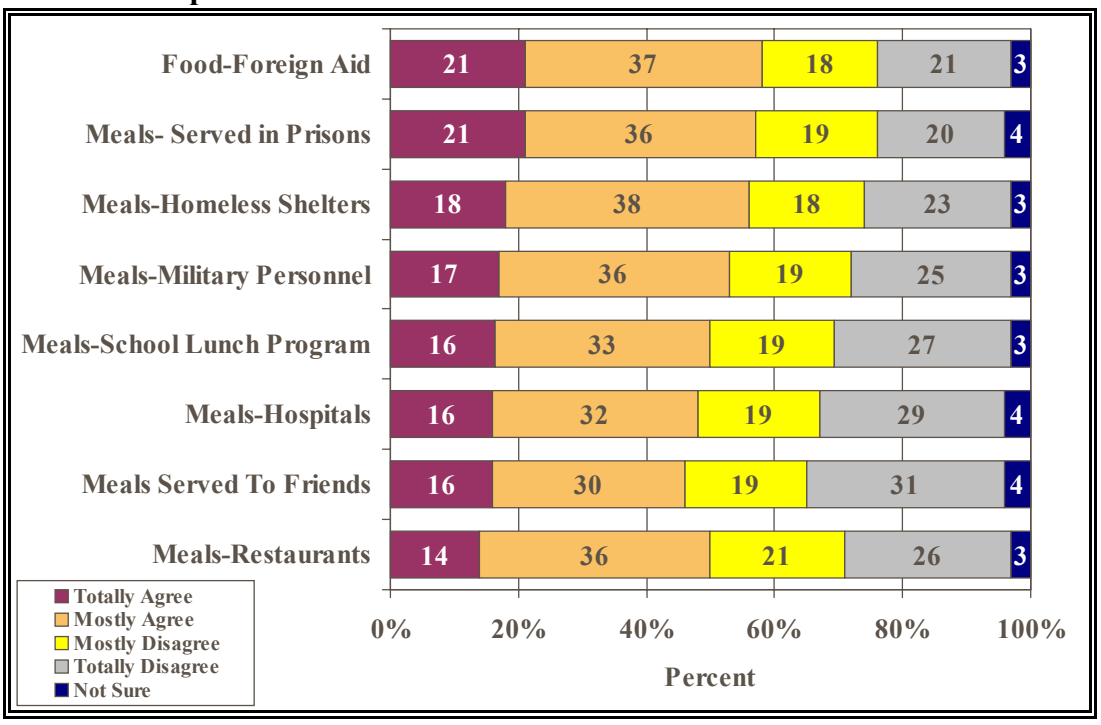
The labeling issue seems to be one of perceived control. People want to know what they are eating, or at least want to know that they have the ability to control whether they are eating GM foods, whether they exercise that control or not. So, while most Americans don't seem willing to go to great lengths to avoid GM foods, many also appear uncomfortable with the idea that they may eat GM foods without knowing it. As such, they may be quite happy to have someone else eliminate the uncertainty about whether the food they are consuming has been genetically modified. For example, when asked about food purchasing/shopping preferences, a little more than half (54 percent) of Americans agreed with the statement "I would prefer to shop in grocery stores that advertise that they do not sell foods containing GM ingredients." A considerably higher percentage (63 percent) expressed a preference for eating in restaurants that advertise that they do not serve foods containing genetically modified ingredients. Furthermore, almost 69 percent of people reported that they would be unhappy if they were served genetically modified food in a restaurant without their knowledge. Given the widespread distribution of

genetically modified corn and soy ingredients, this suggests that many consumers might be surprised and disappointed to learn that their last restaurant meal likely included GM foods.

It comes as no surprise that the vast majority of Americans feel strongly about the right to know whether the foods they eat have been produced through genetic modification. Many express a preference to shop or eat in establishments that either specify which foods contain genetically modified ingredients or advertise that they do not sell foods that contain genetically modified ingredients. But how willing are Americans to have persons other than themselves consume genetically modified foods?

As shown in Figure 11, Americans appear a little more willing to have genetically modified foods consumed by those more socially removed from themselves (for example as part of foreign food aid or meals served to prisoners). Conversely, Americans are more reluctant to agree to the introduction of genetically modified food in venues that they, or people they care for, might frequent (e.g., restaurants) or persons for whom society typically feels a sense of paternalism or social responsibility (e.g., needy children, military personnel, etc.).

Figure 11: Agreement that GM Foods Are Acceptable as Part of Meals Served to Various Populations.



Conclusions

This study is a necessary starting point for understanding public opinions of genetically modified products. The initial findings illustrate the wide diversity and uncrystallized nature of American attitudes. This position is despite the billions of dollars that have already been spent on biotechnology to develop new and improved foods, fuels, feeds, fibers, pharmaceuticals, and nutraceuticals. Given the potential economic, social and environmental impacts it should be obvious that this initial glimpse into public opinion, while important, is not enough. Continued research is imperative to help consumers, farmers, industrialists and policy makers to evaluate the role of genetic modification in the future marketplace.

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Appendix A

American Opinion Research **Job# 06206**
279 Wall St.
Princeton, NJ 08540

March 9, 2001
FINAL DRAFT

PUBLIC PERCEPTIONS OF AGRICULTURAL BIOTECHNOLOGY

[RECORD DAY OF WEEK]

1 SUNDAY
2 MONDAY
3 TUESDAY
4 WEDNESDAY
5 THURSDAY
6 FRIDAY
7 SATURDAY

Hello! I'm_____ calling for the Food Policy Institute at Rutgers University. We're conducting a survey on food, health and technology. We're interested only in your opinions. **I'm not trying to sell you anything and no sales call will result from this interview**.

Because we must interview an equal number of males and females, may I please speak:
[ROTATE SCREENER A AND B]

A. With a male, 18 years of age or older who had the most recent birthday in your household? IF NO MALES EXIST, ASK: May I speak to the female who is 18 years or older who had the most recent birthday?

B. With a female, 18 years of age or older who had the most recent birthday in your household? IF NO FEMALES EXIST, ASK: May I speak to the male who is 18 years or older who had the most recent birthday?

[INTERVIEWER: RECORD SEX OF RESPONDENT HERE:]

1. MALE
2. FEMALE

Q1. To begin with, would you rate your own basic understanding of how food is grown and produced as: [READ LIST; ACCEPT ONE RESPONSE]

1. Excellent
2. Very good
3. Good
4. Fair
5. Poor
8. Not sure (Vol.)
9. Refused (Vol.)

Q2. Would you rate your own basic understanding of science and technology as: [READ LIST; ACCEPT ONE RESPONSE]

1. Excellent
2. Very good
3. Good
4. Fair
5. Poor
8. Not sure (Vol.)
9. Refused (Vol.)

Q3. Is anyone in your family allergic to particular foods or food products?

1. Yes
2. No
8. Not sure (Vol.)
9. Refused (Vol.)

Q4. How important is it that the fruits and vegetables you eat are grown organically, is it:

1. Extremely important
2. Very important
3. Somewhat important
4. Not very important
5. Not at all important
6. Don't know what organic means (Vol.)
8. Not sure (Vol.)
9. Refused (Vol.)

Q5. Now I'm going to read you a list of foods with a particular health benefit. I'd like to know how much more or less willing you would be to consume these foods as compared with regular foods. Using a scale of 10 to 1 where 10 means *Completely Willing* and 1 means *Completely Unwilling* and using any number in between, how willing would you be to consume (PRODUCT) if it tasted and cost the same as regular (PRODUCT) but had (BENEFIT)?

[INTERVIEWER: READ AND ROTATE PRODUCTS AND BENEFITS] [1 x 7 = 7 combinations / 3 cells of 400]

Products:

Orange Juice
Breakfast cereal made with grain
Hamburger made with beef

Benefit:

Added calcium for healthy teeth and bones
Added omega compounds to lower cholesterol to prevent heart disease
Added vitamins and minerals for better nutrition
Added zinc to prevent the common cold
Added anti-oxidants to slow the aging process
Added compounds to improve memory and concentration
Added Vitamin A to improve sight

Q6. Traditionally, to create hybrid plants, the pollen of one variety of plant is used to cross-fertilize another variety. A similar method is used to crossbreed varieties of chickens or varieties of cows or varieties of other animals. Have you heard about these methods?

1. Yes
2. No
8. Not sure (Vol.)
9. Refused (Vol.)

Q7. As far as you know, have you ever eaten a fruit or vegetable created using these methods?

1. Yes
2. No
8. Not sure (Vol.)
9. Refused (Vol.)

Q8. In general, do you approve or disapprove of creating hybrid plants using these methods? Do you: [READ LIST; ACCEPT ONE RESPONSE]

1. Strongly approve
2. Somewhat approve
3. Somewhat disapprove
4. Strongly disapprove
8. Not sure (Vol.)
9. Refused (Vol.)

Q9. Do you believe that creating hybrid plants using these methods is morally wrong or not?

1. Morally wrong
2. Not wrong
3. Depends (Vol.)
8. Not sure (Vol.)
9. Refused (Vol.)

Q10. In general, do you approve or disapprove of creating hybrid animals using these methods? Do you:
[READ LIST; ACCEPT ONE RESPONSE]

1. Strongly approve
2. Somewhat approve
3. Somewhat disapprove
4. Strongly disapprove
8. Not sure (Vol.)
9. Refused (Vol.)

Q11. Do you believe that creating hybrid animals using these methods is morally wrong or not?

1. Morally wrong
2. Not wrong
3. Depends (Vol.)
8. Not sure (Vol.)
9. Refused (Vol.)

[SAMPLE WILL BE SPLIT INTO THIRDS AND RANDOMLY ASSIGNED a, b or c.]

Q12. 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.

When you think about [READ LIST], what is the first thought or image that comes to mind?

a. genetic engineering (_____)
b. genetic modification (_____)
c. biotechnology (_____)

Q13. Genetic modification 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 genetic engineering or biotechnology. How much have you heard or read about these methods?

1. A great deal
2. Some
3. Not much
4. Nothing at all
8. Not sure (Vol.)
9. Refused (Vol.)

Q14. As far as you know, have you ever eaten a fruit or vegetable created using genetic modification methods?

1. Yes
2. No
8. Not sure (Vol.)
9. Refused (Vol.)

Q15. As far as you know, are there any foods produced through genetic modification in supermarkets now?

1. Yes
2. No
8. Not sure (Vol.)
9. Refused (Vol.)

Q16. Do you think that foods created through genetic modification should have special labels on them?

1. Yes
2. No
8. Not sure (Vol.)
9. Refused (Vol.)

Q17. If you were shopping for fresh vegetables and you saw some that were labeled as having been produced using genetic modification, would you be any more or less willing to purchase them or it would not make a difference?

1. More Willing
2. Less Willing
3. Would not make a difference
8. Not sure (Vol.)
9. Refused (Vol.)

Q18. When you are shopping, would you take the time to look for fruits and vegetables that

carried labels stating that they were not genetically modified?

1. Yes
2. No
8. Not sure (Vol.)
9. Refused (Vol.)

Q19. In general, do you approve or disapprove of creating hybrid plants using genetic modification? Do you:
(READ LIST; ACCEPT ONE RESPONSE)

1. Strongly approve
2. Somewhat approve
3. Somewhat disapprove
4. Strongly disapprove
8. Not sure (Vol.)
9. Refused (Vol.)

Q20. Do you believe that creating hybrid plants using these methods is morally wrong or not?

1. Morally wrong
2. Not wrong
3. Depends (Vol.)
8. Not sure (Vol.)
9. Refused (Vol.)

Q21. In general, do you approve or disapprove of creating hybrid animals using genetic modification? Do you: (READ LIST; ACCEPT ONE RESPONSE)

1. Strongly approve
2. Somewhat approve
3. Somewhat disapprove
4. Strongly disapprove
8. Not sure (Vol.)
9. Refused (Vol.)

Q22. Do you believe that creating hybrid animals using these methods is morally wrong or not?

1. Morally wrong
2. Not wrong
3. Depends (Vol.)
8. Not sure (Vol.)
9. Refused (Vol.)

Q23. Please tell me whether you think the following statements are true or false.
[ROTATE LIST AND READ]

(Vol.)

	True	False	Not Sure	(Vol.) Refused
a. There are some bacteria which live on waste water.				
b. Ordinary tomatoes do not contain genes, while genetically modified tomatoes do.				
c. If a person eats a genetically modified fruit, their genes could be modified as a result.				
d. The father's genes determine whether the child is a girl.				
e. The yeast used to make beer contains living organisms.				
f. Genetically modified animals are always larger than ordinary animals.				
g. It is impossible to transfer animal genes to plants.				
h. Tomatoes genetically modified with genes from catfish would probably taste "fishy."				
i. Genetically modified foods are created using radiation to create genetic mutations.				

Q24. Now I'm going to read you a list of genetically modified foods with a particular health benefit. I'd like to know how much more or less willing you would be to consume these foods as compared with regular foods. Using a scale of 10 to 1 where 10 means *Completely Willing* and 1 means *Completely Unwilling* and using any number in between, how willing would you be to consume (PRODUCT) if it tasted and cost the same as regular (PRODUCT) but was genetically modified using (SOURCE OF DNA) to have added (BENEFIT)?

[INTERVIEWER: READ AND ROTATE PRODUCTS AND BENEFITS] [1 x 2 x 7=14 / 3 cells of 400]

Products:

Orange Juice
Breakfast cereal made with grain
Hamburger made with beef

Source:

Genetically modified with carrot DNA
Genetically modified with beef DNA

Benefit:

Added calcium for healthy teeth and bones
Added omega compounds to lower cholesterol to prevent heart disease
Added vitamins and minerals for better nutrition
Added zinc to prevent the common cold
Added anti-oxidants to slow the aging process

Added compounds to improve memory and concentration
Added Vitamin A to improve sight

Q25. Based on what you know, do you approve or disapprove of scientists using genetic modification methods to create: [ROTATE LIST AND READ]

	Strongly Approve	Somewhat Approve	Somewhat Disapprove	Strongly Disapprove	(Vol.) Not Sure	(Vol.) Refused
a. better tasting fruits and vegetables.						
b. fruits and vegetables that last longer on a supermarket shelf.						
c. fruits and vegetables that are less expensive.						
d. hormones like insulin that help people with diabetes.						
e. hormones that enable cows to give more milk.						
f. more nutritious grain that could feed people in poor countries.						
g. hormones that enable cows to produce beef with less cholesterol.						
h. new types of grass that don't need to be mown as often.						
i. rice with enhanced vitamin A to prevent blindness.						
j. sheep whose milk can be used to produce medicines and vaccines.						

Q26. All plants, whether they are genetically modified or not, contain natural chemicals that help protect them from some pests and diseases. Using genetic modification, 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 strongly agree, somewhat agree, somewhat disagree, or strongly disagree with each of the following statements about these kinds of plants. [ROTATE AND READ EACH STATEMENT]

e. Growing genetically modified plants that contain higher levels of naturally occurring chemicals that protect against pests and disease is better than using pesticides.

b. Food that is produced from genetically modified plants that contain higher levels of naturally occurring chemicals that protect against pests and disease should be considered "organic".

c. Food that is produced from genetically modified plants that contain higher levels of naturally occurring chemicals that protect against pests and disease should ***NOT*** be sold in "natural" food stores.-

1. Strongly agree
2. Somewhat agree
3. Somewhat disagree
4. Strongly disagree
8. Not sure (Vol.)
9. Refused (Vol.)

Q27. Now I will read you a few statements. For each, please tell me whether you agree strongly, agree somewhat, disagree somewhat, or disagree strongly. [ROTATE LIST AND READ EACH ITEM]

a. The potential danger from genetic modification is so great that strict regulations are necessary.
b. The risks of genetic modification have been greatly exaggerated.
c. It would be better if we did not know how to do genetic modification at all.
d. Scientists in this country know what they are doing, so only moderate regulations on genetic modification are probably necessary.
e. Unjustified fears about genetic modification have seriously blocked the development of beneficial foods.
f. We have no business meddling with nature.
g. Most farmers would prefer to farm organically rather than use chemical pesticides and fertilizers.
h. The balance of nature can be easily disrupted by humans.
i. Farmers will have to plant genetically modified crops or go out of business.
j. Humans are not perfect, so serious accidents involving genetically modified foods are bound to happen.
k. Nature is so complex it is impossible to predict what will happen with genetically modified crops.
l. Companies involved in creating genetically modified crops believe profits are more important than safety.
m. The government does not have the tools to properly regulate genetically modified foods.
n. Most food in this country is produced on family farms.
o. Most genetically modified foods were created because scientists were able to make them, not because the public wanted them.
p. I would be unhappy if I were served genetically modified food in a restaurant without knowing it.
q. I would prefer to eat in restaurants that advertise that they do not serve foods containing genetically modified ingredients.
r. I would prefer to shop in grocery stores that advertise that they do not sell foods containing genetically modified ingredients.
s. Government regulators have the best interests of the public in mind.

1. Strongly Agree

2. Somewhat Agree
3. Somewhat Disagree
4. Strongly Disagree
8. Not Sure (Vol.)
9. Refused (Vol.)

Q28. From what you know or have heard, do you think genetic modification will make the quality of life for people such as yourself better or worse?

BETTER (IF "BETTER" PROBE, "IS THAT":)
1. Much better
2. Somewhat better

WORSE (IF "WORSE" PROBE, "IS THAT":)
3. Somewhat worse
4. Much worse

8. NOT SURE (Vol.)
9. REFUSED (Vol.)

Q29. Tell me if you totally agree, mostly agree, mostly disagree, or totally disagree that genetically modified foods are OK as part of: [ROTATE LIST AND READ]

a. Meals served to needy children in the free school lunch program.
a. Meals served to people in the military.
c. Food sent as aid to foreign countries.
d. Meals served in homeless shelters.
e. Meals served in restaurants.
f. Meals served to hospital patients.
g. Meals served in prisons.

1. Totally Agree
2. Mostly Agree
3. Mostly Disagree
4. Totally Disagree
8. Not Sure (Vol.)
9. Refused (Vol.)

Q30. Please tell me whether you totally agree, mostly agree, mostly disagree, or totally disagree with the following statements about biotechnology or more specifically genetically modified foods. [ROTATE LIST AND READ]

a. Even if genetically modified food has advantages, it is basically against nature.
b. Genetically modified food threatens the natural order of things.
c. If something went wrong with genetically modified food, it would be a global disaster.
d. Genetically modified food is simply not necessary.
e. The idea of genetically modified food causes me great concern.

f. Whatever the risks involved in genetically modified food, we can avoid them if we really want to.
g. Genetically modified food will benefit many people.
h. If a majority of people were in favor of genetically modified food, it should be permitted.
i. Decisions about the issue of genetically modified food is so complicated that it is a waste of time to consult the public on this subject.
j. The risks involved in genetically modified food are acceptable.
k. Genetically modified food presents no danger for future generations.
l. I would buy genetically modified fruit if it tasted better.
m. I would pay more for non-genetically modified food.
n. I would sign a petition against biotechnology.
o. I would be willing to participate in public debates or hearings concerning biotechnology.
p. I would take time to read articles or watch television programs on the advantages and disadvantages of the advances in biotechnology.
q. I feel that I am adequately informed about biotechnology.
r. I would be willing to buy cooking oil containing a little genetically modified soybean oil.
s. If all traces of genetic modification were eliminated from genetically modified sugar cane, I would be happy to eat this sugar.
t. I would be willing to eat the eggs of hens fed on genetically modified corn.
u. I would be willing to serve genetically modified foods to my friends.

1. Totally agree
2. Mostly agree
3. Mostly disagree
4. Totally disagree
5. Not sure (Vol.)
6. Refused (Vol.)

Q31. Before this interview, have you ever discussed modern biotechnology with anyone?

1. Yes
2. No
8. Not sure (Vol.)
9. Refused (Vol.)

[ASK Q32 IF "YES" IN Q31; OTHERWISE, SKIP TO Q34]

Q32. Would you say you have discussed this issue. [READ LIST AS WRITTEN]

1. Frequently
2. Occasionally

3. Only once or twice
8. Not sure (Vol.)
9. Refused (Vol.)

Q33. Currently, there are a series of commercials about biotechnology showing on television, can you recall having seen any of these commercials?

1. Yes
2. No
3. Not sure (Vol.)
4. Refused (Vol.)

Finally, I have a few questions for classification purposes only:

Q34. What was your age on your last birthday? [RECORD EXACT AGE]

___ Exact age
97. 97 or older
– Not sure (Vol.)
2. Refused (Vol.)

[ASK Q35 IF "DON'T KNOW" OR "REFUSED" IN Q34; OTHERWISE, SKIP TO Q37]

Q35. I don't need to know exactly. Are you [READ LIST]?

1. 18 to 24
2. 25 to 34
3. 35 to 44
4. 45 to 54
5. 55 to 64
6. 65 or older
8. Not sure (Vol.)
9. Refused (Vol.)

Q36. What is the last year or grade of school you completed? [INTERVIEWER: PROBE FOR LAST LEVEL OF FORMAL EDUCATION]

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

Q37. 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?

1. Employed full time
2. Employed part time
3. In the military
4. Unemployed
5. Retired
6. Student
7. Homemaker
8. Disabled/too ill to work
9. Refused (Vol.)

[ASK Q38 IF PUNCHS "1", OR "2" OR "3" IN Q37; OTHERWISE, SKIP TO Q39]

Q38. Does your job involve:

a. Growing, or processing food?
b. Preparing or selling food?
c. Are you a scientist or engineer?
d. Are you a medical professional?

1. Yes
2. No
8. Not sure (Vol.)
9. Refused (Vol.)

Q39. Are you currently single, married, unmarried but living with a partner, separated, divorced or widowed?

1. Single
2. Married
3. Unmarried but living with a partner
4. Separated
5. Divorced
6. Widowed
8. Don't know (Vol.)
9. Refused (Vol.)

Q40. **Including yourself**, how many adults, 18 years or older, currently live in your household?

##___ NUMBER
01 None (UNACCEPTABLE REPONSE. REPEAT QUESTION.)

98 Don't know (Vol.)

99 Refused (Vol.)

Q41. Do you have any children 17 years or younger living in the household?

1. Yes
2. No
8. Don't know (Vol.)
9. Refused (Vol.)

[ASK Q42 IF "YES" IN Q41; OTHERWISE, SKIP TO Q43]

Q42. What are the ages of these children? [RECORD AGE FOR EACH CHILD]

Q43. How would you describe the community where you live? Would you consider your community to be: [READ LIST; ACCEPT ONE RESPONSE]

1. Large or medium sized city
2. Suburban area
3. Small city
4. Rural
5. Other (Specify): _____
8. Don't know (Vol.)
9. Refused (Vol.)

Q44. Are you a member of or do work for any: [READ ITEM]?

a. Environmental groups or organizations
b. Scientific groups or organizations
c. Consumer groups or organizations

1. Yes
2. No
8. Not sure (Vol.)
9. Refused (Vol.)

[ASK Q45 IF MORE THAN ONE IN Q40 OR "YES" IN Q41; OTHERWISE, SKIP TO Q46]

Q45. Do you do most of the food shopping for your household or would you say the task is equally divided?

1. Yes

2. No
3. Equally divided
9. Refused (Vol.)

Q46. During an average month, do you attend a church or other house of worship? [READ LIST; ACCEPT ONE RESPONSE]

1. At least once a week
2. Several times a month
3. At least once a month
4. Less than once a month
5. Never
8. Not sure (Vol.)
9. Refused (Vol.)

Q47. Regardless of the political party you might favor, do you consider yourself to be a liberal, conservative, or somewhere in between?

1. Liberal
2. Conservative
3. Somewhere in between
8. Don't know
9. Refused (Vol.)

[ASK Q48 IF "SOMEWHERE IN BETWEEN" IN Q47; OTHERWISE, SKIP TO Q49]

Q48. Do you lean more toward the liberal side or more toward the conservative side?

1. Liberal
2. Conservative
3. Somewhere in between
8. Don't know
9. Refused (Vol.)

Q49. Are you, yourself, of Hispanic origin or descent that is Mexican, Puerto Rican, Cuban, Central American, South American or some other Spanish background?

1. Yes
2. No
8. Don't know (Vol.)
9. Refused (Vol.)

Q50. Are you white, African-American, Asian or Pacific Islander, Native American or of some other race?

1. White
2. African-American
3. Asian or Pacific Islander
4. Native American
5. Other (Specify) (_____)
8. Don't know (Vol.)
9. Refused (Vol.)

Q51. Would you say your total household income for 2000 was below $50,000 or was it $50,000 or above?

1. Below $50,000
2. $50,000 or above
8. Don't know (Vol.)
9. Refused (Vol.)

[ASK Q52 IF "BELOW $50,000" IN Q51; OTHERWISE, SKIP TO Q53]

Q52. Was it [READ LIST]?

01 Under $25,000
02 $25,000 - $34,999
03 $35,000 - $49,999
98 Don't know (Vol.)
99 Refused (Vol.)

[ASK Q53 IF "$50,000 OR ABOVE" IN Q51]

Q53. Was it [READ LIST]?

04 50,000 - $74,999
05 $75,000 - $99,999
06 $100,000 - $124,999
07 $125,000 or more
98 Don't know (Vol.)
99 Refused (Vol.)

Q54. Code State

Thank you very much for your cooperation. Because my supervisor might want to check on my work, may I please have your first name?

[THANK AND TERMINATE]

Appendix B.

	Category of First Thought or Image													
First Thought or Image	No answer	Science	Negative	Positive	Cloning	Sheep	Other Animals	People	Changing Things	Plants	Business/Stocks	Science Fiction	Other	Total
refused	8													8
don't know	211													211
chemicals/ chemistry		19												19
DNA/ genes /cells		63												63
laboratory/ test tubes/ experiments		33												33
science /technology /biology		88												88
Frankenstein /freak /monster /mutant /deformity			59											59
wrong /bad /don't approve/ immoral			47											47
unnatural /disgusting /disturbing /gross/ scary /yuck			19											19
test tube babies			6											6
fake /artificial /additives /man-made			18											18
tampering/ playing God /mad scientist			20											20
danger/ evil /death /disaster /disease			23											23
uncertainty/ unintended consequences			16											16
eugenics/ Hitler			7											7
germs/ bacteria			9											9
good /in favor/ approve				6										6
improvement/ making things better/ benefits /progress				50										50
medicine /drugs /health				24										24
future /modern				11										11
food				14										14

cloning					148									148
sheep						58								58
chickens							3							3
cows							6							6
pigs							3							3
animals							14							14
other animals							3							3
babies / children /kids								9						9
humans /people								12						12
changing things /altering things									19					19
plants										17				17
corn										13				13
tomatoes										5				5
wheat										4				4
other plants										10				10
growing things/ life										4				4
big business/ agribusiness											9			9
stock market											10			10
science fiction												13		13
computers /robots /machines												12		12
TV													4	4
fertilizer													3	3
farms/ agriculture													3	3
transplantation													5	5
organic													4	4
hybridization/ breeding													21	21
OTHER													40	40
TOTAL	219	203	224	105	148	58	29	21	19	53	19	25	80	1203