Journal of Rural Social Sciences

Volume 19
Issue 2 *Southern Rural Sociology Special Issue: Forestry in the South (2003)*

Article 7

12-31-2003

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Southern Rural Sociology, Vol. 19, No. 2, 2003, pp.132-152

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ABSTRACT Biotechnology represents a new generation of scientific and technological advancements, and has the potential to result in profound changes in twenty-first century agriculture. Since the general public are the consumers of biotechnology products, public acceptance is vital. This article presents the results of a survey of a random sample of Texas residents on two significant issues. First, to what extent is the general public supportive of biotechnology, and second, are there some segments of the population that are more supportive of biotechnology than other segments. Survey results make it apparent that the Texas general public has a clear mandate about two aspects of biotechnology. First, there is widespread support for research on plant biotechnology and the resulting products. A second clear mandate was that the public was adamantly opposed to research on human cloning. Respondent's views about animal biotechnology were split, with about equal numbers favoring and opposing research on animal biotechnology and the resulting products. Respondents most favorable to biotechnology included older people, males, persons with more education and higher incomes, those with more faith in science and technology, and those who perceive positive outcomes from biotechnology. Some implications of these findings are discussed.

Throughout U.S. history, developments in science and technology have had a profound impact on agriculture, farm families and rural communities (Cochrane 1979). During the twentieth century, mechanical developments in agriculture increased farm production and allowed the more efficient use of human labor, which made it possible for farmers to manage larger operations (Dorner 1983). This resulted in larger and fewer farms, a rapid reduction in the farm population, and extensive changes in rural communities (Albrecht and Murdock 1990). However, by the latter decades of the 20th century it was clear that the steady increases in productivity occurring as a result of these mechanical developments were leveling off as efficiency scales and

biological barriers were encountered (Molnar and Kinnucan 1989; Ruttan 1994).

Biotechnology represents a new generation of scientific and technological advancement, and perhaps, developments in biotechnology will result in the most profound changes in twenty-first century agriculture (Mannion 1995; Penn 2000). Biotechnology is a process whereby scientists 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. Possible advantages are numerous. Biotechnology has the potential to greatly increase agricultural productivity. By changing the genetic makeup of plants and animals, it is possible to give the plant or animal increased resistance to environmental stresses such as heat and drought. In addition, biotechnology can be used to create plants and animals that grow faster and larger, are more nutritious, taste better and last longer before spoiling. At the same time, biotechnology can preserve scarce resources and keep harmful contaminants out of the environment through the development of plants that are more resistant to insects and diseases, which thus allow farmers to use fewer pesticides (Sporleder 2000).

With the mechanization of agriculture that occurred during the 20th century, scientists generally proceeded under the assumption that developments in science and technology represented progress and would bring benefits to society (Dunlap and Mertig 1992). During this earlier era it was believed that the primary purpose of Extension and the social sciences was to get farmers to adopt new ideas and technologies as quickly as possible (Fliegel and van Es 1983). During the latter part of the twentieth century, assumptions that developments in science and technology always brought benefits to society were seriously questioned. As a result of incidents such as the nuclear accidents at Three Mile Island and Chernobyl, health problems resulting from air and water pollution and chemical waste (Carson 1962), and numerous other problems, public concerns with science and technology increased dramatically. Even public confidence in the universities and government agencies involved with science and technology has declined considerably in recent decades (Campbell 1995).

With challenges to the basic invincibility of science, biotechnology and other new developments must now face public scrutiny before being accepted by the general public. Since the general public are the consumers of biotechnology products, public acceptance is vital.

Farmers will be reluctant to grow products with biotechnology unless assured of consumer acceptance and thus a market for their products (Hoban 1997; Priest 2000a). For example, bioengineered corn and soybeans varieties were first introduced in 1996, and by 1999 almost 25 percent of the corn and 50 percent of the soybeans acreage was planted with varieties created by biotechnology (Boehlje 2000; James 1999). However, many farmers went back to conventional seeds in 2000 (Fabi 2000). The reason was that farmers were concerned that public resistance to biotechnology could translate into lower demand and thus lower prices for their products. Of special concern are several European and Asian nations that are willing to pay higher prices for U.S. food products if assured that these products are biotechnology free (Mattson 2000).

Given the importance of public acceptance for the future of biotechnology, two significant issues will be addressed in this manuscript. First, to what extent is the general public supportive of biotechnology, with which lines of research and with which products are they most comfortable, and to what extent are they willing to consume biotechnology products? Second, it is vital to know if there are segments of the population that are more supportive of biotechnology than other segments and why. These are important questions to which there has been surprisingly little research. Those studies that have been conducted show extensive disagreement and uncertainty among the American general public (Hoban and Katic 1998; Israel and Hoban 1992; Priest 2000b). With answers to these important questions, researchers will be in position to carefully explore those issues for which the general public exhibits the greatest concern and make sure these issues have been dealt with to the satisfaction of the public before the biotechnology products are released. Once there is sufficient evidence of the benefits, safety and social and environmental consequence of each biotechnology product to justify its release, knowledge from this and similar studies can be used to develop educational programs to reach relevant segments of the population.

The ultimate focus and first objective of this manuscript will be to explore the extent to which the general public support a variety of biotechnology products and are willing to purchase and consume these products. Variables measuring views toward these products and consumer behavior will be the dependent variables in the analysis. Descriptive statistics showing the degree of acceptance or approval of

Figure 1: Model to Guide the Analysis

Personal Characteristics and Faith in Science	→	Perceived Outcomes or Consequences of Biotechnology	→	Views and Behaviors Regarding Specific Biotechnology Products and Consumer Behavior

biotechnology will achieve the first objective of this study. To accomplish the second objective, analysis will be conducted to determine if certain segments of the population are more likely than other segments to support or oppose biotechnology. For this analysis, it is expected that views of respondents toward these biotechnology issues and products will be a function of their personal characteristics, their views and attitudes toward science and technology in general, and their expectations regarding the major outcomes or consequences of biotechnology. This model is based on assumptions of self-interest. Persons most likely to be supportive of biotechnology and different biotechnology products are most likely to be those who perceive that they or persons like them will benefit from the product. A model that will guide this analysis is graphically presented in Figure 1. The manuscript continues by providing a brief description of each segment of the model.

Personal Characteristics and Faith in Science and Technology

The extent to which individuals with different characteristics vary in their views toward biotechnology is an important issue with significant policy and educational implications. In this analysis four personal characteristics will be used: age, gender, education and income. Obviously, other variables could be used. These four variables, however, have been useful on numerous other issues, and should provide important insights on biotechnology. With virtually no research exploring the relationship between these personal characteristics and views toward biotechnology, it will be necessary to develop hypotheses on adaptations from research on other issues. The first personal characteristic is age. Relative youth is often associated

with a greater willingness to accept new ideas and to be critical of the status quo (Dalton 1994; Mertig and Dunlap 2001). It is thus expected that younger respondents will be more supportive of biotechnology than older respondents. Regarding gender, women, it is argued, are socialized into nurturant and protective roles in which they are more concerned with the welfare of others and the welfare of the planet (Chodorow 1978; Mertig and Dunlap 2001). It is thus expected that women will be more resistant and conservative toward biotechnology, while men are more likely to support growth and technological advance and consequently be supportive of biotechnology. It is also expected that respondents who are better educated and have higher incomes will express more support for biotechnology than those with less education and lower incomes. Persons with higher levels of education are likely to have a more thorough understanding of biotechnology and thus have less fear of the unknown. Persons with higher incomes are more likely to be in a position where they can personally benefit financially from developments in biotechnology and also have a more in-depth understanding of biotechnology processes (Fliegel and van Es 1983).

Another critical factor influencing views toward biotechnology may be the extent to which an individual has confidence or faith in the institutions of science and technology. As noted earlier, acceptance of the virtues of science and technology was nearly universal in the United States several decades ago. While there has been extensive erosion of this confidence among some segments of the population, it is expected that persons retaining higher levels of confidence in science and technology will be more supportive of biotechnology than persons with less confidence and faith.

Outcomes or Consequences of Biotechnology

Some of the major arguments surrounding biotechnology regard the extent to which biotechnology will result in human health, environmental or economic benefits or costs, and the extent to which biotechnology will make life easier or more convenient. As for environmental concerns, opponents argue that the pesticides built into genetically modified crops may harm "nontarget" species such as Monarch Butterflies. A second environmental concern is that genes might jump to weeds when crops breed with nearby relatives creating "superweeds." Finally, there is concern that insects will eventually develop resistance

to the pesticides built into the crops through biotechnology and such insects will be even harder to control. On the other hand, proponents argue that biotechnology does not add anything unnatural or harmful to the genetically modified plants and animals. Proponents note that selective breeding to develop plants and animals with more desirable characteristics has been occurring for centuries, and biotechnology is largely utilizing modern knowledge to transfer genes more quickly and precisely. Proponents also maintain that biotechnology will result in plants naturally resistant to insects and other pests and thus greatly reduce the amount of chemicals required.

Relative to health and safety concerns, some critics maintain that the new genes might disrupt other genes, creating unexpected toxins or reducing nutrient levels (Hallman and Metcalfe 1995). On the other hand, supporters of biotechnology maintain that biotechnology holds the potential of creating plants and animals with higher nutritional content, and even have the ability to genetically insert ingredients into the plant or animal that will prevent or cure disease (Penn 2000).

Supporters of biotechnology also contend that by developing faster growing, more efficient, and longer lasting products, biotechnology will result in products that are cheaper for consumers in the grocery store. Proponents also believe that biotechnology will result in products that will make life easier and more convenient. Others are not so confident of the cost, ease and convenience advantages. In this study, it is expected that respondents who feel that biotechnology will result in positive human health, environmental and cost outcomes and will make life easier and more convenient are more likely to be supportive of biotechnology than respondents with less favorable views.

Views and Behaviors Regarding Biotechnology

The views of the general public toward six specific biotechnology products and their consumer behavior relative to biotechnology products will be the dependent variables in this analysis. Initially, respondents were asked about the extent to which they approved or disapproved of using biotechnology to create new (1) plants and (2) animals. Respondents were then asked about the desirability of two specific products developed through biotechnology, (3) BT seeds and (4) Bovine Somatotropin (BST). BT seeds produce crops that are resistant to insects and other pests, which then allows farmers to use

fewer pesticides. BST is a hormone that stimulates milk production in cows. Scientists are now able to produce this hormone through biotechnology, and by injecting the hormone into the cow, milk production can be increased. Next, respondents were asked about how desirable it was that research on both (5) animal and (6) human cloning be continued. Finally, an attempt was made to determine the extent to which respondents were willing to purchase products with biotechnology at the grocery store.

Methods

Data for this study were obtained from a mail survey conducted during the spring of 2000. The major purpose of the survey was to seek the opinions of respondents about science and biotechnology. A sample of 5,000 names was randomly drawn to be representative of all Texas households. The sample of names was purchased from an agency established for this task. An initial mailing was sent to all potential respondents. This mailing consisted of the questionnaire, a cover letter, and a postage paid return envelope. Up to three follow-up mailings were sent to individuals who had not yet returned the questionnaire. Of the original 5,000 names in the sample, 675 people had moved or for some other reason could not be reached. Of the remaining 4,325 potential respondents, 2,211 returned usable questionnaires for a response rate of 51.1 percent. A comparison of respondents with all Texas adults as described by the 2000 Census (U.S. Bureau of the Census 2000) shows extensive similarities.

The measurement of the four personal characteristics (age, gender, education and income) was straightforward. For gender, males were given a code of 0 and females a code of 1. For the faith in science and technology variable, respondents were asked about the effects of science and technology on their life and the lives of other Americans. Specifically, respondents were asked whether the comfort, safety, health, and economic prosperity of Americans were (1) much worse to (4) much better as a consequence of developments in science and technology. Respondents were questioned about the effects of science and technology over the past 50 years, the past 10 years, and 10 years into the future. A total of 12 items were used. Thus for the total index, the range of possible scores was from 12 (a total lack of faith in science and technology) to 48 (extensive faith in science and

Table 1: Overview of Indexed Variables Used in the Study (N=2,221).

Variable	Number of Items	Possible Range	Mean	Median
Independent Variable				
Faith in Science	12	12-48	38.9	39
Consequences				
Environmental	5	5-20	11.8	12
Human Health	6	6-22	16.2	16
Cost	5	5-20	12.3	12
Ease and Convenience	3	3-12	8.3	8
Attitudes and Behaviors				
Consumer Behavior	7	7-28	17.0	16

technology). Table 1 provides an overview of the indexed variables used in this study. This table shows that the average score was 38.9, with a median of 39.

The four outcome or consequence variables were created by summing responses to several survey questions. The environment variable was based on five questions. Respondents were asked about the likelihood of (a) environmental preservation because farmers used less pesticide and (b) genetically engineered seeds having harmful effects on some plants and animals in the environment. Respondents were also asked about the extent to which they agreed or disagreed with statements about (c) hybrid plants and animals posing a danger to the environment, (d) the dangers associated with human interference with nature, and (e) the dangers to humans of pesticide application on fruits and vegetables. When necessary, the direction of scoring was reversed so that a high score meant that the expected consequences of biotechnology for the environment were positive. Table 1 shows that for the environment variable, possible scores ranged from 5 to 20, with mean and median scores both about 12.

The human health consequences were measured by six items asking about the extent to which biotechnology products were safe for human consumption, and the respondent's belief that biotechnology

could result in more nutritious foods, and plants with added medical properties to prevent, control or cure human disease. Table 1 reveals that the human health index had a possible range of from 6 to 22, with mean and median scores of about 16. Again, a high score indicates confidence that biotechnology will have positive human health consequences.

The cost index was created with five variables measuring the extent to which respondents thought that biotechnology would result in more affordable food in the grocery store. Table 1 shows that this index had a possible range of 5 to 20, with a high score again indicating confidence in positive outcomes from biotechnology. The median and mean scores for this index were both about 12.

Finally, three items were used to determine the extent to which respondents felt that biotechnology would make their lives easier and more convenient. This index included questions about using biotechnology to make grass that doesn't need to be mowed as often and foods that taste better and fresher. This variable has a possible range of three to twelve with a high score indicative of confidence that biotechnology will have positive outcomes. Table 1 shows that respondents had a mean and median score of about 8 on this index.

An attempt was also made to measure consumer behavior relative to biotechnology. For this index, respondents were given a list of seven products (apples, corn, tomatoes, rice, milk, beef, and baby food). For each product, they were asked whether they were (1) not at all willing (2) not very willing, (3) somewhat willing, or (4) very willing to purchase that product with biotechnology if it was the same price as the same product without biotechnology. The possible range of scores for this index was 7 to 28 with a high score indicating a greater willingness to consume biotechnology. Survey respondents had a mean score of 17.0 and a median score of 16.

The first part of the data analysis will be a descriptive overview of the dependent variables to assess the extent to which the general public accepts various aspects of biotechnology and are willing to consume products with biotechnology. A set of regression models will then be computed to determine which segments of the population are most supportive of biotechnology. This will accomplish the second objective of the study. The first set of regression models will examine the relationship between the respondent's personal characteristics and their views about the outcomes or consequences (environmental, human

health, cost and ease and convenience) of biotechnology. Regression models will then be conducted to determine the relationship between both the personal characteristics and the expected outcomes or consequences of biotechnology on the respondents views of the acceptability of specific biotechnology products and processes and their consumer behavior relative to biotechnology.

Findings

Table 2 provides a descriptive overview of the survey respondent's views toward biotechnology. First, respondents were asked about the extent to which they approved or disapproved of using biotechnology to create new plants and animals. It is obvious that respondents were much more favorable toward plant biotechnology than animal biotechnology. More than three-fourths of the respondents either strongly approved (21 percent) or approved (56 percent) of using biotechnology to create new plants. The proportion who approved of biotechnology to create new animals was significantly less (10 percent strongly approved and 36 percent approved). Thus, more than one-half of the respondents disapproved of using biotechnology to create new animals.

The preference of survey respondents to plant biotechnology over animal biotechnology is further evidenced when comparing the use of BT Seeds with the use of Bovine Somatotropin (BST). Nearly four out of five respondents stated that the continued used of BT Seeds, a form of plant biotechnology, was either very desirable (19 percent) or desirable (60 percent). In contrast, just over one-half found the continued use of BST, an animal biotechnology, to be either very desirable (6 percent) or desirable (47 percent). Continuing the trend of respondents being about evenly split on their opinions toward animal biotechnology, just over one-half stated that research on animal cloning was either very desirable (15 percent) or desirable (40 percent). In contrast, opposition to research on human cloning was nearly universal with 28 percent stating that it was undesirable and over 50 percent maintaining that it was very undesirable.

In Table 3, data are presented which show details of respondent's willingness to consume biotechnology products. This table shows that about two-thirds of the respondents maintained that they were very willing or somewhat willing to purchase plant products from biotechnology (apples, corn, tomatoes and rice). For each of these

Table 2: Extent to Which Survey Respondents Approve or Desire Biotechnology Products and Processes (N=-2,211).

Product	Extent of Approval (Percent)			
	Strongly Approve	Approve	Disapprove	Strongly Disapprove
Using Biotechnology to Create New Plants	21.1	56.1	15.9	6.9
Using Biotechnology to Create New Animals	9.6	35.8	35.8	18.8

Product	Extent of Approval (Percent)			
	Very Desirable	Desirable	Undesirable	Very Undesirable
Continued Use of BT Seeds	19.1	60.3	16.2	4.4
Continued Use of Bovine Somatotropin (BST)	6.0	47.0	37.8	9.2
Research on Animal Cloning	14.5	40.4	26.0	19.1
Research on Human Cloning	6.0	14.3	28.2	51.5

products, about one-fourth of the respondents said that they were very willing and an additional 40 percent said that they were somewhat willing to purchase these products. As has consistently been the case, respondents were less favorable toward animal biotechnology and thus less willing to purchase animal biotechnology products. About one-half of the respondents were very or somewhat willing to purchase milk or beef produced with biotechnology. Finally, respondents expressed the greatest caution in regard to baby food, where 14 percent were very willing and an additional 24 percent somewhat willing to purchase baby food produced with biotechnology.

Table 4 presents the first set of regression models designed to

Table 3: Extent to Which Survey Respondents Would Be Willing to Purchase Biotechnology Products if They Were the Same Price as That Product Without Biotechnology (N=2,211).

Products	Very Willing	Somewhat Willing	Not Very Willing	Not At All Willing
Apples	24.8	41.7	20.1	13.4
Corn	25.1	41.6	19.9	13.4
Tomatoes	25.3	40.9	19.9	13.9
Rice	25.0	41.7	19.7	13.6
Milk	18.0	32.3	30.4	19.3
Beef	16.9	31.3	30.8	21.0
Baby Food	14.0	24.4	28.8	32.8

complete the second objective of this study by showing which segments of the population are most and least favorable toward biotechnology. Table 4 presents four regression models where the respondent's personal characteristics and their faith in science are the independent variables and the perceived consequences of biotechnology are the dependent variables. For these four models, the relationships tended to be rather weak, and the amount of variance explained in the dependent variables ranged from only 4 to 16 percent.

The first personal characteristic in these regression models is age. Age was not significantly related to any of the perceived consequences of biotechnology. On three of the four regression models (environmental, human health and cost), it was found that, as expected, males were more favorable toward biotechnology than females. The relationship between education and the perceived consequences of biotechnology was significant for three of the four models. Respondents with higher levels of education were more likely to perceive that biotechnology will have environmental and human health benefits, and were less likely to perceive favorable ease and convenience outcomes from biotechnology. Persons with higher incomes, as expected, were most likely to expect positive environmental consequences from biotechnology. The strongest variable in all four regression models was faith in science. As

Table 4: Regression Models Showing Unstandardized and Standardized Regression Coefficients (in parentheses) between Independent Variables and the Perceived Consequences of Biotechnology (N=2,211).

	Perceived Consequences of Biotechnology							
Independent Variable	Environmental		Human Health		Cost		Ease and Convenience	
Age	.00	(.00)	.00	(.02)	.00	(.01)	.01	(.07)
Gender	-.88*	(-.15)	-1.09*	(-.15)	-.77	(-.11)	-.15	(-.04)
Education	.20*	(.13)	.16*	(.08)	.02	(.01)	-.12*	(-.11)
Income	.12*	(.09)	.10	(.06)	.04	(.02)	.03	(.03)
Faith in Science	.09*	(.19)	.20*	(.31)	.19*	(.31)	.06*	(.17)
Intercept	7.80*	(.00)	8.46*	(.00)	5.52*	(.00)	6.15*	(.00)
F-Value	38.84*		52.83*		37.61*		13.45*	
R-Square	.12		.16		.12		.04	

*Statistically significant at the .01 level.

expected, respondents who felt that science and technology had brought and would continue to bring comfort, safety, health and an improved environment into their lives were most likely to perceive positive consequences from biotechnology.

Table 5 presents regression models where the extent of support for specific biotechnology products and processes were the dependent variables. In the stage one models, shown on the top panel of Table 5, only the personal characteristics and faith in science are utilized as independent variables. These models explain only a limited amount of the variation in the dependent variables (4 to 18 percent). Age was significantly related to three of the biotechnology variables, creating new animals, using BT seed, and consumer behavior, and in each case it was older respondents who expressed greater support for biotechnology. This finding was opposite of what was expected. Gender was significantly related to all of the dependent variables except one, and in each case males expressed greater support for biotechnology than females. Education was significantly related to three of the seven biotechnology variables (creating new animals, using BST, and research on animal cloning). In each case, the relationship was as predicted in that respondents with higher levels of education expressed more support for biotechnology. Income was significantly related to three of the biotechnology variables, creating new plants, using BT seeds, and research on animal cloning, and in each case, as expected, persons with higher incomes expressed the greatest amount of support for biotechnology. The final variable in the stage one models was faith in science. For each of the seven biotechnology variables this was the strongest variable in the model, and in each case, persons with higher levels of confidence in science and technology expressed the greatest support for biotechnology.

The bottom portion of Table 5 show the stage two regression models. These models have the same dependent variables (the extent of support for biotechnology), and utilize both the personal characteristics and faith in science, and also the perceived consequences of biotechnology as the independent variables. Overall, these models were able to explain a substantial amount of the variation in the extent of support for biotechnology for all of the variables except research on human cloning. Opposition to human cloning research was nearly universal and thus there was little variation that could be explained. The independent variables explained between 35 and 45

Table 5: Regression Models Showing Unstandardized and Standardized Regression Coefficients (in parentheses) Between Independent Variables, Perceived Consequences of Biotechnology, and Extent of Support for Biotechnology (N=2,211).

	Extent of Support for Biotechnology													
Independent Variable	Creating New Plants		Creating New Animals		Using BT Seeds		Using BST		Research on Animal Cloning		Research on Human Cloning		Consumer Behavior	
	Stage One Models													
Age	.00	(.04)	.00*	(.08)	.01*	(.13)	.00	(.06)	.00	(.04)	-.00	(-.00)	.04*	(.10)
Gender	-.08	(-.05)	-.23*	(-.12)	-.18*	(-.11)	-.24*	(-.15)	-.27*	(-.13)	-.19*	(-.09)	-1.20*	(-.09)
Education	.01	(.03)	.06*	(.12)	.02	(.05)	.03*	(.08)	.06*	(.11)	.02	(.05)	.22	(.06)
Income	.06*	(.15)	.03	(.07)	.03*	(.10)	-.00	(-.02)	.04*	(.08)	.02	(.04)	.12	(.04)
Faith in Science	.04*	(.31)	.04*	(.27)	.05*	(.34)	.04*	(.31)	.05*	(.26)	.02*	(.13)	.34*	(.28)
Intercept	.86*	(.00)	.27*	(.00)	.81*	(.00)	.87*	(.00)	.48*	(.00)	.91*	(.00)	1.72*	(.00)
F-Value	48.73*		43.21*		61.97*		41.45*		44.55*		11.49*		35.64*	
R-Square	.15		.13		.18		.13		.13		.04		.11	
	Stage Two Models													
Age	.00	(.02)	.00*	(.07)	.01*	(.11)	.00	(.04)	.00	(.03)	-.00	(-.00)	.04*	(.09)
Gender	.04	(.02)	-.07	(-.03)	-.04	(-.03)	-.11*	(-.07)	.10*	(-.05)	-.08	(-.04)	.22	(.02)
Education	-.00	(-.00)	.03	(.06)	.01	(.02)	.02	(.04)	.04*	(.07)	.01	(.02)	-.04	(-.01)
Income	.04*	(.10)	.01	(.01)	.02*	(.06)	-.02	(-.06)	.01	(.01)	.01	(.01)	-.04	(-.01)
Faith in Science	.02*	(.13)	.02*	(.09)	.02*	(.15)	.02*	(.12)	.02*	(.09)	.02	(.02)	.10*	(.08)

Table 5 Continued: Regression Models Showing Unstandardized and Standardized Regression Coefficients (in parentheses) Between Independent Variables, Perceived Consequences of Biotechnology, and Extent of Support for Biotechnology (N=2,211).

	Extent of Support for Biotechnology													
Independent Variable	Creating New Plants		Creating New Animals		Using BT Seeds		Using BST		Research on Animal Cloning		Research on Human Cloning		Consumer Behavior	
Perceived Consequences														
Environmental	.05*	(.17)	.06*	(.17)	.03*	(.13)	.02*	(.09)	.05*	(.14)	.03*	(.08)	.54*	(.22)
Human Health	.06*	(.26)	.08*	(.32)	.07*	(.31)	.08*	(.35)	.07*	(.27)	.04*	(.16)	.64*	(.34)
Cost	.04*	(.17)	.04*	(.15)	.04*	(.20)	.04*	(.16)	.06*	(.21)	.05*	(.17)	.47*	(.23)
Ease and Convenience	.02	(.05)	-.02	(-.04)	.02*	(.06)	.03*	(.07)	.01	(.02)	-.01	(-.02)	-.34*	(-.10)
Intercept	-.27*	(.00)	.99*	(.00)	-.35*	(.00)	-.29*	(.00)	-.95*	(.00)	.06	(.00)	-8.42*	(.00)
F-Value	84.02*		86.11*		116.48*		88.74*		84.94*		23.35*		125.86*	
R-Square	.35		.36		.43		.37		.36		.13		.45	

* Statistically significant at the .01 level.

percent of the variation in the other models.

Even with the addition of the perceived consequence variables, age was still significantly related to support for the same three biotechnology variables and in each case, older respondents were most supportive. Gender was now significantly related to only two of the biotechnology variables, and in each case females expressed greater opposition than males for biotechnology. Education was significantly related to only research on animal cloning, where persons with higher levels of education expressed the greatest amount of support for biotechnology. Income was significantly related to two of the biotechnology variables, and as expected, persons with higher incomes were the most supportive of biotechnology. Finally, persons with higher levels of faith in science were more supportive on all of the biotechnology variables except research on human cloning.

An examination of the perceived consequence variables indicates that respondents who expected positive outcomes from biotechnology were most likely to express support for the specific biotechnology products and processes. Respondents who expected more positive environmental outcomes from biotechnology were most likely to support all of the biotechnology products and processes and were also most likely to purchase products with biotechnology. Respondents expecting positive human health outcomes from biotechnology were most supportive of all of the biotechnology products. For each variable but one, this was the strongest variable in the models. The cost variable was significantly related to all of the dependent variables. In each case, respondents perceiving cost benefits were most supportive of biotechnology. The ease and convenience variable was only weakly related to three of the dependent variables. Respondents who perceived ease and convenience benefits were most supportive of using BT seeds and using BST, but were less likely to consume biotechnology products.

Conclusions

In this study, the Texas general public provides a clear mandate about several aspects of biotechnology. First, it is very clear that there is widespread support for plant biotechnology. The Texas general public was very supportive of research on plant biotechnology and favorable to the resulting products. A second clear mandate was that the public was adamantly opposed to research on human cloning. Respondent's

views about animal biotechnology were split, with about equal numbers favoring and opposing research on animal biotechnology and the resulting products.

Concerning variations in the views of different segments of the population, it was found that personal characteristics were of only limited value in understanding variations of opinions. Age was only weakly related to views about biotechnology, and when significant, it was the older respondents who were most supportive of biotechnology. This was contrary to speculation. There was a consistent and relatively strong relationship between gender and views toward biotechnology. Females consistently expressed greater resistance toward biotechnology than did males. Both education and income were only weakly related to views about biotechnology. When significant, respondents with higher levels of education and with higher incomes expressed more support for biotechnology. It was consistently found that respondents with greater faith in science and technology were most supportive of biotechnology. Respondents who believed that biotechnology would have positive environmental, human health, cost and ease and convenience consequences tended to be more favorable toward specific biotechnology products and were more willing to consume biotechnology products. The strongest predictive variable utilized in this study was human health. Respondents who felt that biotechnology will result in products that will make their lives healthier and safer were strongly supportive of biotechnology.

This study was conducted with a random sample of Texas residents. The extent to which residents in other parts of the country are different from or similar to Texas residents is obviously a question of critical importance. In recent elections, Texans have tended to be somewhat conservative. It is unclear if this means Texans will be more or less supportive of biotechnology than others. It is vital that national surveys be conducted in the future. Further, in an increasingly global world, the value of international studies is evident. Also, opinions of biotechnology are likely to change quickly as knowledge levels and the number of products increase. Continued future research is thus essential. Based on this study, however, it seems evident that researchers can move forward with plant biotechnology knowing they have widespread public support. In this study, opposition to human cloning research was nearly universal.

It is also critical that improved theoretical models be developed to understand and predict which segments of the population are most and least supportive of biotechnology. In this study it was found that older persons, males and those with higher levels of education and higher income were more supportive than others in biotechnology. A better understanding of why these relationships exist and which other variables are important is critically needed.

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