

AGRICULTURAL BIOTECHNOLOGY AND PUBLIC ATTITUDES IN THE EUROPEAN UNION

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The latest European sample survey of public perceptions of biotechnology shows that Europeans continue to support medical applications of biotechnology but have become increasingly opposed to genetically modified (GM) foods. Furthermore, while the cloning of human cells and tissues is supported, the cloning of animals is not. The survey shows considerable differences in public opinion on applications of biotechnology across the European Union (EU) member states, highlighting the difficulties for European level policy making, and provides some indications as to the bases of resistance to GM foods and animal cloning.

Key words: biotechnology; public perception; Europe.

Like information technology, biotechnology is a "strategic" technology with the potential to impact many areas of contemporary society including agriculture, farming and foods. Our interest in researching public perceptions of biotechnology goes beyond the idea of describing how the public responds to technology after the fact, as if public opinion is nothing more than a response to the technology. Rather we see public opinion as part of the symbolic environment, which influences the trajectory of new technologies. New technologies can develop within a context of public support, or as in European today, public opinion may actively constrain and influence the course of development of biotechnology (see Durant, Bauer & Gaskell, 1998).

This paper presents results from a recent survey of the European public's view of biotechnology and is the result of work by the International Research Group on Biotechnology and the Public, funded by the European Commission's Directorate General for Research. (see also Gaskell *et al.*, 2000). The Group comprises researchers from fourteen European member states, with associated teams in the United States and Canada.

The fourth Eurobarometer on biotechnology was conducted in each European Union country in 1999 using a multi-stage random sampling procedure, which provides a statistically representative sample of national residents, aged 15 and over. The total sample within the EU was 16,082 and the results are weighted to 1,000 persons per EU country. The survey was designed by the International Research Group as part of a larger study of biotechnology in the public sphere involving the comparative analysis of public perceptions, media coverage and public policy from 1973 to the present.

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Public Opinion Of Biotechnology: An Overview

In the survey respondents were asked whether they thought each of seven biotechnologies was useful, risky, morally acceptable, and whether it should be encouraged. The response alternatives provided were: definitely agree (+2); tend to agree (+1); tend to disagree (-1) and definitely disagree (-2). Each application was described in a sentence as follows: *Genetic testing*, using genetic tests to detect inheritable diseases such as cystic fibrosis; *Medicines*, introducing human genes into bacteria to produce medicines or vaccines, for example, to produce insulin for diabetics; *Bio-remediation*, genetically modified bacteria to clean up slicks of oil or dangerous chemicals; *Cloning human cells or tissues* to replace a patient's diseased cells that are not functioning properly; *GM Crops*, transferring genes from plant species into crop plants to increase resistance to insect pests; *Cloning animals* such as sheep, to get milk which can be used to make medicines and vaccines and *GM food*, using modern biotechnology in the production of foods, for example, to make them higher in protein, keep longer or change the taste.

Figure 1 presents the mean scores for the whole of Europe. There are four indicators for each of the seven applications, the average judgments of usefulness, risk, moral acceptability, and whether it should be encouraged or supported. In figure 1 the horizontal line represents a neutral judgment. Above the line shows that the particular application is increasingly considered useful, risky, morally acceptable and to be supported.

Figure 1: European Attitudes to Seven Applications of Biotechnology.

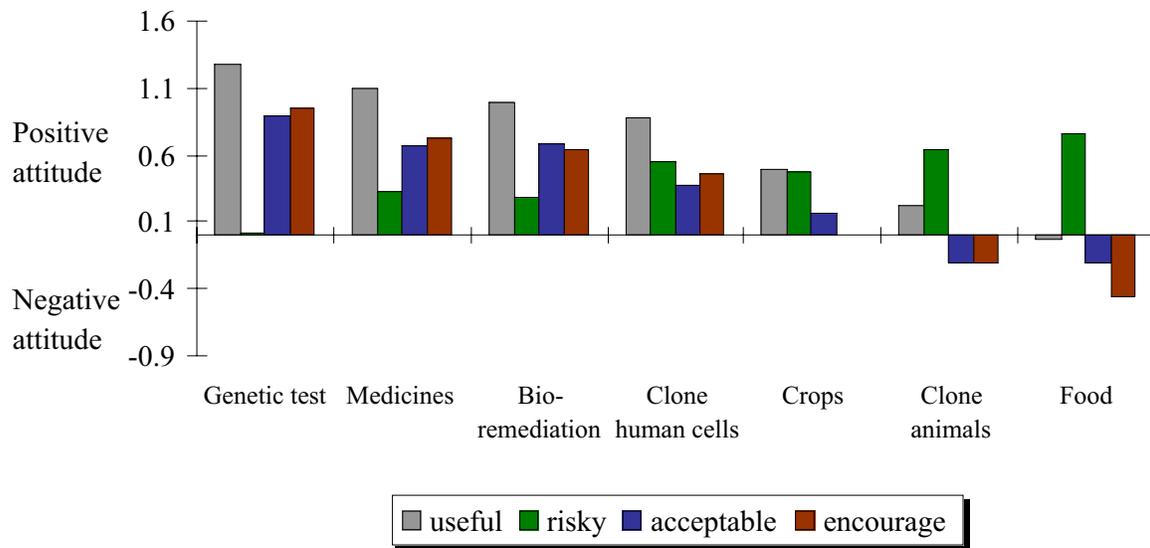


Figure 1 shows that the public clearly distinguish between different applications of biotechnology. In terms of overall support, Europeans are neutral about agricultural biotechnology, and opposed to both GM foods and the cloning of animals. By contrast, and despite the opposition to GM foods, perceptions of medical biotechnologies (genetic testing, and the production of pharmaceuticals) and environmental biotechnologies (bio-remediation) are very positive. So the idea that the European public is anti biotechnology can be discounted. People have differentiated views depending on the

application under consideration. The figure shows a consistent pattern in the structure of public perceptions across the seven applications of biotechnology. As the perceived usefulness of applications declines so is there an increase in perceived risk, and a decline in moral acceptability and support. Usefulness, the 'Achilles heel' of the first generation of GM food products, is a pre-condition for support. Indeed the absence of apparent consumer benefits from GM foods may even accentuate perceived risks and moral concerns. By contrast, where people perceive biotechnologies to have substantial benefits, for example in health care, they are willing to tolerate risks (GM medicines and cloning human cells). However, where biotechnologies are perceived to have only modest benefits, which come with modest levels of risk, there is no positive support (GM crops).

There are two further and interesting contrasts from these results.

- *Food safety versus biosafety.* The first contrast is between public perceptions of GM foods and GM crops. Why is the European public neutral to genetically modified crops but strongly opposed to GM foods? The figure shows the differential support is associated with different perceptions of use, risk, and moral acceptability. The negative perceptions of GM foods may be the result of the BSE crisis and other food scares, which have heightened public sensitivities to what they eat. People simply do not want to take the risk of eating GM foods and the absence of labeling and consequent denial of choice in the matter is the crucial concern. The environmental issues relating to GM crops that have been the rallying cry of some activist groups are apparently of lesser concern to the wider public, for whom food safety and choice are the issues.
- *Cell cloning versus animal cloning.* The other interesting contrast is between cloning human cells and tissue and cloning animals, such as "Dolly" the sheep. It is possible that we would have found a negative and emotional reaction to the word "cloning". But this is not the case. While the cloning of animals for medical purposes is widely rejected, the cloning of human cells and tissues for similar purposes receives moderate support. This suggests that the public is making judgments beyond specific techniques, such as cloning, to take into consideration the scope of intervention, perhaps whole versus part cloning, and its intended uses. Perhaps for the public, as was evidenced in much of the media coverage, the cloning of Dolly the sheep opened a Pandora's Box: Would cloning people and eugenics would be coming next?

National Profiles

Thus far, we have treated Europe as if it were a single entity, which of course it is not. Table 1 shows the profile of support and opposition for the seven applications by country. The applications are represented by the following letters: GM foods (F), cloning animals (Ca), cloning human cells (Ch), crops (C), use of bacteria for environmental remediation (B), medicines and pharmaceuticals (M), genetic testing (G).

In general genetic testing, medicines, and bacteria are positively viewed in all European countries. Genetically modified foods are the most negatively viewed application of biotechnology in all countries except Finland. It is the least welcomed development of biotechnology across the European Union. But the cloning animals is also a sensitive topic, being negatively viewed in many countries, with the exception of Portugal, Finland, and Spain which are modestly positive. It is tempting to categorize these country profiles by geographical region or some such comparative dimension, and to attempt to explain the differences by reference to religious or cultural differences. Tempting but probably naïve. That said, part of the explanation may come from the position of countries in relation to economic development.

Table 1: Support for Seven Applications by Country.

Country Rank (1996)		← Negative		Positive	→		
Austria	Greece	F	Ca	C Ch	B M	---	G Greece
Germany	Austria	---	F C	Ca	Ch B M G	---	---
Sweden	Luxemburg	---	F C	Ca	B Ch	G M	---
Denmark	Sweden	---	F	Ca C	B Ch	G M	---
Luxemburg	Denmark	---	F	C Ca	---	Ch B G M	---
Ireland	Ireland	---	---	F Ca C	Ch	M B G	---
Netherlands	United Kingdom	---	---	F C Ca	Ch	B M G	---
United Kingdom	Germany	---	---	F Ca	C Ch	G M B	---
France	Belgium	---	---	F C Ca	B	Ch M G	---
Belgium	France	---	---	F Ca C		M B Ch	G
Greece	Italy	---	---	F Ca	C	Ch B M	G
Italy	Netherlands	---	---	F Ca	C	Ch M B	G
Finland	Portugal	---	---	F	Ca	C M B	Ch G
Spain	Finland	---	---	---	Ca F C	M B G	---
Portugal	Spain	---	---	---	F Ca	C	Ch B M G

Note. F = genetically modified food; C = genetically modified crops; Ch = cloning human tissue; Ca = cloning of animals; B = bio-remediation; G = genetic testing; and M = medicines.

It is notable that the three countries that are most positive towards modern biotechnology, Portugal, Finland, and Spain, are the newly emerging and modernizing economies of Europe. Perhaps in these countries biotechnology is seen as a vehicle for aspired to technological progress and economic development. At the other extreme, among the least supportive countries are Austria, Luxembourg, Sweden, and Denmark, all advanced economies with high levels of gross national product (GNP). One consequence of prosperity is the emergence of new value orientations and more skeptical beliefs about the link between technology and progress. Progress, while still valued, is not accepted at any price. The public, or at least some of the public, demand the opportunity to decide whether they are willing or not to support new technological developments.

Table 1 also shows the rank ordering of countries in terms of relative support for biotechnology as of 1996. In general, the European countries, which were relatively more negative in 1996, have remained negative in 1999, for example, Austria, Sweden and Denmark. However, Greece has become one of the more critical member states, while Germany and the Netherlands have all become relatively more positive. In 1999, as in 1996, Finland, Portugal, and Spain remain the most supportive of biotechnology.

The German public's shift to a relatively more supportive ranking is paralleled by some specific national developments over the last three years; for example, greater government support for the biotechnology industry, the relaxing of some regulatory policies, and the establishment of venture capital funding initiatives. By contrast the decline in support in Greece may be the result of an intensive national campaign against biotechnology leading, amongst other things, to supermarket boycotts of GM foods.

The major food chains are emerging as important actors in relation to GM foods. In the United Kingdom, for example, a small supermarket chain, whose Chief Executive is a member of Greenpeace, announced that there would be no GM ingredients in their products. Other supermarkets followed suit and withdrew GM products, not so much on the grounds of safety but rather to protect their competitive position. Focus group research, which we conducted in Britain, indicated that the supermarkets decisions on GM foods confirmed public anxieties. People said to us, "Well, that is just what we thought. We've been eating these unsafe things for years and nobody told us."

Analyzing Perceptions

In order to analyze public perceptions about GM foods further, we can collapse the responses to the four questions posed earlier into a "yes" or "no" dichotomy (useful/not useful, risky/not risky and so on). With this approach we find only three prevalent patterns of response, or what may be called logics: "Supporters" who say "yes" the application of biotechnology is useful, "no" it is not risky, "yes" it is morally acceptable, and, "yes," I am prepared to encourage it; "Opponents" who hold the mirror image of the supporter logic. They say that the application is not useful, it is risky, it is morally unacceptable, and they are not prepared to encourage it. And the third logic is that of "risk tolerant supporters." These are people who say, it is useful, it is morally acceptable, and it is to be encouraged, they also perceive some risks but are prepared to discount them (see table 2).

Table 2: Three Common Logics.

Logic	Useful	Risky	Morally Acceptable	Encouraged
1: Supporters	YES	NO	YES	YES
2: Risk Tolerant Supporters	YES	YES	YES	YES
3: Opponents	NO	YES	NO	NO

The logics shown in table 2 were the only three of the sixteen possible combinations of yes/no responses that were adopted by a substantial percentage of the European public's judgments across all the applications of biotechnology included in the survey. The other possible logics attracted no more than 5% of the European public.

The analysis of the logics provides a basis for time series comparisons. Four applications of biotechnology that were included in both the 1999 survey were also used in the 1996 Eurobarometer (see Gaskell *et al.*, 1997). For these four applications we can see how public opinion, in terms the distribution of the logics of support, risk tolerant support, and opposition, has changed over the period. The relevant percentages for 1996 and 1999 are shown in table 3. In the case of GM foods,

for example, the table shows that in 1996, 31% of respondents were supporters, 30% risk tolerant supporters, and 39% were opponents; hence, 61% expressed some form of support, with 39% against. By 1999, supporters had dropped to 22%, risk tolerant support to 25%, and now a majority of Europeans, 53% adopted the opponent logic. Note here that the baseline for calculating these percentages is only those respondents who opted for one of the three logics, what we may call the "decided public." All respondents who failed to answer one of more of the four questions about a particular application or whose responses were outside the three common logics have been excluded. In other words, the analysis excludes those with "non attitudes" and also those with a full set of responses, which feel into a logic held by less than 5% of the population.

Once again the overall European figures mask large national differences. As an illustration consider the distribution of the logics across the European member states with respect to GM foods. Table 4 is based on the procedures described for table 3. Hence, the percentages are based on only the "decided public," those respondents who answered all the questions, and opted for one of the three dominant logics. Here, it can be seen that in Greece 81% are opponents of animal cloning, with 12% supporters, and 2% risk tolerant supporters. Overall, for every one supporter of either type, 14% in total, there are almost six opponents. By contrast, in the Netherlands 25% are opponents, 21% supporters, and 54% risk tolerant supporters. Here for every one opponent there are three taking one form of supporting logic. Such striking differences underline the difficulties faced by those seeking to develop European level policies that will carry support public support in all the member states.

The Bases of Public Perceptions

The survey provides some suggestions as to what lies behind the public's concerns about animal cloning and GM foods. Respondents were asked the extent to which they agreed or disagreed with a series of propositions about the moral implications and associated risks of one of the two applications (a split ballot was used where half the respondents were asked about animal cloning and the other half about GM foods). Table 5 shows for GM food the percentages of supporters, risk tolerant supporters, and opponents who agreed or strongly agreed with particular propositions.

Thus for example when asked whether "GM foods threaten the natural order," 90% of opponents tend to agree or strongly agree. But what is surprising is that 65% of risk tolerant supporters and 50% of supporters also agree with it. It appears that even those who support GM foods think it is a threat to the natural order. The statement "I dread the idea of GM food" is taken from the risk perception literature, which shows that dread risks are amongst the most negatively evaluated (Fischhoff *et al.*, 1978; Slovic, Lichtenstein, & Fischhoff, 1998). Presented with this statement, 84% of opponents agreed or strongly agreed, as did about one third of the supporters and risk tolerant supporters. Finally, when asked, "Even if GM food has benefits it is fundamentally unnatural," more than half of supporters agree.

For animal cloning an even more extreme pattern of responses was found. The striking, and I think important, result is not so much that the greater majority of opponents worry about the unnaturalness of GM foods and animal cloning, but that many of those who are prepared to support these applications are also concerned. Many Europeans experience the dread factor in forming their risk perception.

The Role Of The Media

The press release about Dolly the Sheep came out in February 1997. This dramatic episode led to a synchronization of the European and probably the international press. Three or four photographs circulated around the world with much the same commentary. Some of the headlines and coverage

were positive ones. For example, in a moment of technological triumphalism one British headline read "The World's first." But within one day the media moved towards phrases like "Hitler's dream." There was a sudden shift from cloning animals for a medical application, to cloning humans.

Table 3: The Logic of Judgment for Seven Applications.

		1996 % (pop.%)	1999 % (pop.%)
Genetic Testing	Supporters	56 (37)	51 (28)
	Risk Tolerant Supporters	38 (25)	41 (22)
	Opponents	7 (4)	8 (5)
Medicines	Supporters	48 (31)	40 (20)
	Risk Tolerant Supporters	43 (28)	47 (23)
	Opponents	9 (6)	13 (6)
Crops	Supporters	45 (26)	34 (15)
	Risk Tolerant Supporters	34 (20)	33 (15)
	Opponents	21 (12)	34 (15)
Food	Supporters	31 (16)	22 (10)
	Risk Tolerant Supporters	30 (16)	25 (11)
	Opponents	39 (20)	53 (24)
Environmental Remediation	Supporters	---	41 (19)
	Risk Tolerant Supporters	---	45 (20)
	Opponents	---	15 (7)
Cloning Human Cells	Supporters	---	31 (15)
	Risk Tolerant Supporters	---	49 (23)
	Opponents	---	15 (10)
Cloning Animals	Supporters	---	24 (11)
	Risk Tolerant Supporters	---	33 (15)
	Opponents	---	37 (19)

Table 4: National Attitudes Towards GM Foods.

	Supporter	Risk Tolerant Supporter	Opponent	All Support
Netherlands	21	54	25	75
Spain	36	34	30	70
Finland	52	17	31	69
Ireland	21	35	44	56
Portugal	26	30	45	56
Italy	19	31	51	50
Germany	30	19	51	49
Belgium	20	27	53	47
United Kingdom	20	27	53	47
Sweden	17	24	59	41
Denmark	14	21	65	35
France	12	23	65	35
Luxembourg	9	21	70	30
Austria	14	15	70	29
Greece	12	2	81	14

Note. Figures are expressed as percentages.

Table 5: The Logic of Judgment for Seven Applications.

	% Who 'Agree' or 'Strongly Agree'		
GM Food...	Supporters	Risk-Tolerant Supporters	Opponents
Threatens the natural order.	50	65	90
Even if has benefits, are fundamentally unnatural.	57	67	92
I dread the idea of...	31	41	84
Poses (no) dangers for future generations.	40	48	85

However, very seldom was the human association positive -- we saw no mentions of Einstein, Aristotle or Leonardo de Vinci. Within three days the coverage of the issue had shifted from animal cloning to eugenics, designer babies, and various other dystopian visions.

Such coverage may have a lasting effect on public perceptions. It is not correct to suggest that the public immediately absorbs media messages. But there are residues of media coverage that cultivate particular ideas and images, which become part of the way people represent a particular science and technology.

Ongoing Public Concerns

The survey research and focus group interviews that we have conducted point to a number of ongoing public concerns. There is a widespread concern that some applications of biotechnology are unnatural, the risks are not understood and that the first applications are harbingers for dreadful developments in the future. Some scientists have challenged the idea that biotechnology is “unnatural,” by pointing out that human societies have been doing this for 10,000 years and all biotechnology does is to make the process quicker and more precise. Such an argument may be of limited persuasive value in the context of cloning or of transferring genes across species. Another concern is what one might call “indecent haste.” People wonder if there is scientific uncertainty, then why are we rushing in? Why not delay developments and new products until the appropriate scientific tests have been completed? There are also worries about who is looking after the public interest, where are the independent experts? On the one hand there is a presumption of a cozy alliance between governments and industry. Many governments have adopted the dual roles of regulator and supporter of biotechnology as part of industrial and economic policy. These two roles lead to concerns about the impartiality of the regulators. As governments trumpet the technology’s future potential, people may think that profit is being put ahead of safety. On the other hand, it appears that many scientists are now industry representatives or venture capitalists. When a scientist appears on television people may wonder if this is one of the old style independent researchers or a businessman with vested interests. One argument in favor of GM foods is the feeding of the Third World and the prospects of a second green revolution. For many people in the West this is not a very credible argument. Citizens in the advanced countries are faced daily with a cornucopia of foods, often imported from Third World countries and ask the question “Why on earth do we need these new GM foods?”

The Global Dimension

In the period 1995-2000 the contrast between the US and Europe in the ease of introducing GM foods is striking and may, in part, have contributed to the current situation in Europe. In the US after a long period of debate, the regulatory arrangements were in place, the public apparently untroubled, and the commercial exploitation of biotechnology was well underway with product approvals and millions of acres planted with new GM seeds. By contrast, the cycle of innovation in Europe was at a much earlier stage. Europe’s collective and national regulatory arrangements were much disputed, little research had been conducted on the environmental and health issues, and the technology itself was very unfamiliar to the public. In this early phase of the innovation cycle, the introduction of imported GM products clearly had a profoundly disturbing impact, accentuated by the BSE (bovine somatotropin encephalopathy) crisis. Interestingly, this disruption has not been a one way process; there is evidence that in reaction to the European controversies, the US public has become increasingly troubled. For example, a number of food manufacturers have sourced non-GM ingredients for baby foods and other popular food lines.

Conclusion

The future of GM foods in Europe is unclear. Against the background of the public concerns outlined in this paper it seems very unlikely that without substantial consumer benefits and persuasive evidence on the safety of GM foods public attitudes will change. However one thing is clear, public opinion cannot be ignored. Public opinion has shaped and will continue to shape the social and political environment of modern biotechnology, and as such will have a determining influence on the trajectory of the technology itself.

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