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**Focus Groups on Agri-food
Applications of Biotechnology
Final Report**

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Office of Consumer Affairs
Industry Canada
9th Floor, 235 Queen Street
Ottawa, Ontario
K1A 0H5

Submitted by:

Ekos Research Associates Inc.

275 Sparks St., Suite 801
Ottawa, Ontario K1R 7X9
(613) 235-7215

145 King St. West, Suite 1000
Toronto, Ontario M5H 3X6
(416) 214-1424

92, boul. St-Raymond, Suite 301
Hull, Québec J8Y 1S7
(819) 595-2955

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CHAPTER

1

INTRODUCTION

The rationale for this project is based on the results from the *Biotechnology Research Design* conducted by Ekos Research. In the preparation of this research design, an extended analysis of the Optima survey data was performed. The analysis subsequently identified current gaps in the information of consumers attitudes, opinions and behaviour regarding biotechnology.

One of the key research gaps was the general public's actual knowledge and understanding of biotechnology. For example, in the Optima survey, respondents were asked if they had "heard of" six biotechnology products and uses listed in one of the questions. As this question taps the consumer's basic awareness levels more than their actual knowledge of the products and uses, a more in-depth understanding of the public's true knowledge was required. # 1

Another aspect of the knowledge issue is the public's awareness of the government's role in biotechnology; does the public understand what roles the government currently undertakes in the area of biotechnology? A related research issue is trust in experts and the credibility of government and other stakeholders in this field. Trust was found during the extended analysis to be a key variable in determining the public's perceptions of biotechnology, but very little is known about who are considered to be the experts and which sources are the most credible. # 2

An additional item of interest was the type of information consumers needed and the notion of labelling. A very high proportion (i.e., 83 per cent) of respondents to the Optima survey indicated a desire for labelling of the biotechnology process employed. This finding was not particularly startling. It has been argued that one might expect respondents to answer positively when asked whether they want labelling. The reason, it is suggested, is that respondents would not perceive any negative consequences associated with labelling. The intent of the current project was to explore this issue in more depth. #3

As well, although support for various applications of biotechnology had been quantified in the Optima survey, little was known about how consumers traded-off the benefits and the risks associated with these applications. It was not known, for example, if consumers tended to attach more weight to personal (i.e., direct) benefits or to societal (i.e., indirect) benefits, nor was it known what effect the type of modification would have on perceptions. #4

The focus of this project was limited to agri-food applications of biotechnology. It was believed that the task of collecting perceptual data could be complicated by the fact that biotechnology is a complex field spanning several domains (e.g., medicine, agriculture, the environment). The use of a single term, such as biotechnology, can evoke a large number of different concepts in the minds of the public making it unclear as to exactly what people are responding to. It was felt that each application area (e.g., agri-food products, environmental applications, reproductive technologies) would have to be examined separately. Agri-food applications of biotechnology were selected because there are a number of products which are currently on the market or are expected to enter the market soon.

The current project has been undertaken as part of initiatives led and coordinated by Industry Canada to achieve better understanding of public perceptions of and attitudes towards biotechnology applications. These initiatives are being undertaken in the context of the government's National Biotechnology Strategy (NBS). The current project was guided by an advisory group which included representatives from Agriculture and AgriFood Canada, Health Canada, and Industry Canada.

1.1 Methodology

As noted in the previous section, a more in-depth treatment was required with respect to knowledge levels, credibility of experts, information needs and risk-benefit trade-offs. Restricted by the amount of information which could realistically be collected, the underlying dimensions associated with these issues could not be explored during the Optima survey. In order to obtain in-depth qualitative information on these issues, the current research proposed a focus group methodology.

A focus group is a qualitative methodology designed to permit the discussion of perceptions and issues in greater depth than is otherwise permitted during a structured interview format; it is an informal group discussion among 8 to 10 people and is facilitated by a moderator. The goal of a focus group is not to provide responses that are statistically representative of a population, rather the aim is to address *what* perceptions exist and explore *why* they exist.

A series of 8 focus groups were conducted: two groups in each of four centres across the country (e.g., Halifax, Montreal, Toronto and Vancouver). Participants were recruited over the telephone at Ekos' centralized survey facility using a random digit dialling technique. Participants were screened out solely on the basis of age (i.e., if they were under 18 years of age) and involvement in special interest groups. It was felt that active members of such organizations would be highly informed stakeholders and so should be excluded from participation. Similarly, no members of the biotechnology industry were included in any of the focus groups.

During recruitment, participants were also asked a number of awareness and knowledge related questions, drawn from other surveys, to obtain some quantitative measures of pre-discussion awareness, knowledge and support. The pre-measure of support for biotechnology would be compared with a post-measure taken at the end of the focus group. ✓

The focus group discussion guide, which may be found in Appendix A, was designed to cover 3 key areas: awareness and perceptions; product reactions (including risk-benefit trade-offs); and information needs.

Participants were first asked to provide a brief description of what they knew about biotechnology. Following this, they were presented 10 specific applications of biotechnology and asked whether they had heard of any of them. The 10 examples were representative of traditional types of biotechnology (e.g., traditional methods of cross-breeding, the use of yeast in bread and beer) and the more recent form of biotechnology (e.g., genetic engineering). After having gone through the list once, participants were then asked to classify these applications into two categories, traditional and non-traditional biotechnology. The classification criteria as well as the images associated with both types of biotechnology were also explored. As a final item, before moving on to product reactions, participants were asked to provide their views on where they saw biotechnology 10 to 20 years hence; how they thought biotechnology would be used in the future.

The eight group discussions in this study focused on agri-food applications of biotechnology. Participants were presented with generic descriptions of two approved, agrifood products: a tomato and a potato¹ (Appendix B). Participants were asked to provide their initial impressions of the products, as well as their impressions after first the benefits, and then the risks were introduced. Product deliberations culminated with a weighting of the risks against the benefits. Both products were discussed separately. The order in which participants were exposed to the two products was rotated across group discussions to avoid any potential bias due to the order of their presentation.

These products were selected to be reflective of direct and indirect (i.e., societal) benefits in order to explore whether consumers attached different weights to these two types of benefits. The tomato was intended to be illustrative of direct consumer benefits. In contrast, the benefits of the potato were thought to be illustrative of societal level benefits, in that planting the potato as an alternative to the use of pesticides might be viewed as protective of the environment. The intent is for the tomato to be grown in the winter. The tomato's ripening process has been delayed so that it can ripen longer on the vine prior to shipping. The intended result is a better tasting, longer lasting, more nutritious tomato. In the other case, a gene was added to the potato to produce a naturally occurring bacterial protein, which is indigestible to the Colorado Potato Beetle. It has been

1. The corresponding products are Calgene's Flavr Savr™ tomato, and Nature Mark's New Leaf™ potato.

estimated that the Colorado Potato Beetle can destroy up to 85 per cent of a potato crop; the use of this potato will result in a reduction in the application of the pesticide used to control this beetle.

The issue of information needs was addressed after the presentation of the first product. In order to avoid influencing participants responses through directed questions, care was taken to ensure that questions were phrased in an open manner. Participants, for example, were asked in general terms, what their information needs were. When participants indicated their needs, questions were posed to seek elaboration and their reasons, rather than pose the direct question of whether they wished to see genetically engineered foods labelled. Although the bulk of the discussion on information needs occurred in the discussion of the first product, participants were also asked what they needed to know about the second product and whether these needs were any different from those of the first product.

As a final exercise, upon completion of the group discussions participants were given a hand-out and asked to rate their overall support for biotechnology on the seven-point scale that had been used during recruitment (Appendix B).

CHAPTER

2

AWARENESS AND PERCEPTIONS OF BIOTECHNOLOGY

2.1 Awareness of Biotechnology

(a) Recruitment

During recruitment, focus group participants were asked a number of quantitative survey-type items in order to gauge their pre-discussion familiarity (e.g., awareness and knowledge) with biotechnology. Awareness was distinguished from knowledge in that awareness consisted simply of having heard of the term biotechnology, whereas knowledge implied knowing and/or understanding some of the details of biotechnology.

The results obtained during recruitment indicated that although awareness was fairly high, self-rated knowledge of biotechnology was moderate at best. Consistent with results on awareness from other surveys of the Canadian public², about three-quarters of focus group participants had heard of the term biotechnology (Appendix C). Of those who were aware, almost one-fifth of participants indicated that they had little or no knowledge of biotechnology. Eighty per cent indicated a moderate level of knowledge, with somewhat fewer people feeling that they could explain biotechnology to a friend (i.e., 70 per cent).

An additional measure aimed at gauging pre-discussion knowledge of biotechnology was based on items from a survey conducted in European Communities³. During recruitment, participants who had heard of the term biotechnology were asked whether the following items were linked to biotechnology:

- q research on the early detection of cancer;
 - q changing hereditary information within an organism to alter that organism's characteristics;
 - q producing new kinds of organisms using hereditary information from other species;
 - q improving traditional methods of cross-breeding plants or animals;
2. Studies conducted by Decima Research and Optima Consultants identified awareness levels of 70 per cent or more for food and health appreciations of biotechnology.
 3. Marlier, E. *Eurobarometer 35.1: Opinions of Europeans and Biotechnology in 1991*.

- q making use of living micro organisms (e.g., plant protection);
- q food processing such as using yeast for the production of bread or beer;
- q treating hereditary human diseases by modifying the tissue involved; and
- q using living organisms to clean up the environment.

Exhibit 2.1 indicates that one quarter of participants aware of biotechnology, accurately identified *all* of the examples as being linked to biotechnology.

EXHIBIT 2.1

Number of examples (out of eight) correctly linked to biotechnology	Number of participants
Four or less example	6
Five	3
Six	11
Seven	17
Eight	13
Total	50

Participants were also asked during recruitment if they could think of any specific examples of biotechnology. Most of the examples cited by participants (about 40 per cent of responses) tended to be associated with agriculture, ranging from a generic area (e.g., "studies on plants) to the specific (e.g., "a new potato that has a clone incorporated in it to be free of a certain disease"). Some specific examples cited by participants included the following:

- q studies on plants/cross breeding plants/hybrid seeds/creating hybrids/ plants that withstand global warming;
- q "changing a plant or animal by modifying their life";
- q use of hormones to increase milk production/BST;
- q accelerated growth program for animals and aquaculture/growth hormones;
- q the "chicken gene"; and
- q Super tomatoes/Flavr Savr™ tomato.

The next most frequently cited examples were related to the environmental and health applications; roughly equal proportions of responses (approximately 20 per cent each) were associated with environmental applications (e.g., using microorganisms to clean up oil spills, protecting the environment) and the Health Sciences (e.g., research and genetic testing for disease, test tube babies). The remaining 20 per cent of responses consisted of the use of the word "genetic" or "cloning" (10 per cent of responses) and a number of largely of unrelated items (10 per cent of responses), for some of which the relationship to biotechnology was unclear. These latter responses included the following:

- q green houses;
- q use of microbes;
- q laser treatment;
- q organically based cleaners;
- q being controlled by mental thought; and
- q biological warfare.

(b) Focus Group Discussion

The generally high awareness indicated during recruitment was confirmed during focus group discussions. Participants were more familiar with specific applications of biotechnology than the term biotechnology. Although people who had never heard of biotechnology were not asked during recruitment what their familiarity was with specific applications of biotechnology, specific examples were presented during the focus group. During group discussions, some of the people who had indicated no awareness of biotechnology during recruitment noted that they were, in fact, familiar with some of the applications of non-traditional biotechnology. Participants indicated that they had heard about biotechnology through such sources as print and television news medias; television shows; and magazines (e.g., National Geographic Magazine).

During group discussions, participants linked biotechnology with the high tech industry, agri-food applications and medical applications. Although some participants had virtually no knowledge of biotechnology, most people were moderately familiar with biotechnology with a few people having fairly sophisticated knowledge. At the outset of the groups, some participants cited specific examples they were familiar with, while others offered a number of personal definitions ranging from a simple description to a technical explanation, such as:

- q "modifying and managing living organisms";
- q "use of technology for the purpose of advancement and development of biology and science and environmental preservation, farming etc.";
- q "process of using bacteria or microbes for leeching out or breaking down materials e.g., to remove gold from ore"; and
- q "basically a science to advance technology, through the use of biosphere, using genes and gene-splicing to advance medicine, agriculture, fishing etc.".

Participants were then presented with a number of specific applications of biotechnology without, at this point, distinguishing between traditional and non-traditional examples and were asked whether they had heard of them. These applications are displayed in Exhibit 2.2 (see Appendix A for precise presentation during group discussions). Most participants had heard of many of the examples presented and, not surprisingly, the traditional biotechnology ones in particular. The use of yeast in the making of bread and beer, for example, was deemed to be "common knowledge".

EXHIBIT 2.2

"Traditional Biotechnology"	"Non-traditional Biotechnology"
q cross breeding plants and animals to change their growth and food quality	q trees that are genetically engineered to grow faster
q using a yeast for the production of bread or beer	q tomatoes that are genetically engineered to have a longer shelf life and to taste better
q the use of bacteria in yoghurt-making	q crops that are genetically engineered to be resistant to insects
q the use of rennet in cheese-making	q bacteria that clean up oil slicks (e.g., the use of naturally occurring microorganisms that feed on chemical compounds, breaking them into non-toxic substances)
q selective breeding of plants and animals	q genetic testing for disease

Participants were then asked to classify these items into two categories; "traditional" and "non-traditional". Participants were not offered definitions of traditional and non-traditional

biotechnology; they were asked to make the classifications based on what they thought these two types of biotechnology might entail. Participants' reasons for classifying items as traditional or non-traditional included whether they were familiar with the example, how long the example had been in existence (e.g., more than 50 years) and whether the application was a natural process or involved genetic engineering.

The term "genetic engineering" caused some initial confusion in a few of the groups. Although an example of non-traditional biotechnology, some people believed that genetic engineering had been in existence for some time, and so should be considered traditional biotechnology. By the end of the exercise, however, there was generally consensus among groups as to the distinctions among the two types of biotechnology (i.e., that the "non-traditional" involved genetic engineering). The types of images participants associated with both traditional and non-traditional biotechnology are presented in Exhibit 2.3.

EXHIBIT 2.3

Images associated with traditional biotechnology	Images associated with non-traditional biotechnology
- q Nature/natural/healthy - q evolution - q ease of production - q "in-breeding". - q bucolic/pastoral - q food/farms	- q laboratories/scientific/genetic/modifying cells/high-tech - q intervention/injections/manipulation/interference/ "fooling nature"/"breaking the laws of nature" - q rapid change/lack of history - q big business/US/multi-sector partnerships - q "leading to a better humanity" - q black plague/Jurassic Park

2.2 Perceptions of biotechnology

Participants spontaneously expressed a mixture of a hope, in which biotechnology had a positive role in the future, and apprehension about who would control the technology and the possibility of dire unintended side-effects.

It was believed by a number of participants that biotechnology would have a pervasive influence in people's lives. The general view held by many participants was that biotechnology could have many positive applications. The main appeal of biotechnology was the long-term possibilities, particularly in medicine; in some groups support had little to do with the immediate possibilities for consumer benefits.

Positive applications notwithstanding, participants expressed scepticism and concern about the ability of governments and corporations to "do the right thing". With respect to government, there was also a concern about whether it could exert enough control when challenged by multinationals, who were perceived to be aggressive and self-serving by some participants.

Biotechnology was also viewed by some people as generating problems rather than solving problems. Biotechnology had the capability, for example, to eliminate jobs and erode a traditional way of life (e.g., farming).

Some participants mentioned that biotechnology was not harmful in and of itself, and that any danger would be the result of an application of the technology. Participants believed that biotechnology had the potential for both "good" and "bad", depending on the application.

(a) *Vision of Biotechnology*

Participants' visions of biotechnology, that is of how they saw biotechnology evolving over the next ten to twenty years, fell into three applications: medical; agri-food; and environmental. Generally, the perceived value of biotechnology was directly related to its ability to provide benefits on a societal scale.

Visions in some groups were heavily laden with images of curing disease and developing new medicines. Environmental applications were also important in some groups. Participants viewed biotechnology as playing a key role in the clean-up of oil spills, in the reduction of the use of pesticides, as well as reducing the burden on the world's resources.

With respect to agri-food applications, participants believed that biotechnology would provide the ability to counter any negative impacts of global warming on agriculture (e.g., creating plants capable of growing in warmer climates). Biotechnology was also viewed as potentially providing a solution to world hunger by increasing production capabilities. The positive feelings generated by this view was tempered by the recognition that an increased capability might not necessarily be used to address world hunger; *"we already throw away tons of good food each year to keep prices up"*.

Although participants' main focus was on the potential for feeding the world, there was some appreciation that biotechnology could also give consumers better selection, quality, nutrition and price.

Visions of biotechnology were accompanied by apprehensions. Four main concerns regarding the future of biotechnology were noted by participants:

- q ethical and moral implications;
- q motivations underlying the development of biotechnology;
- q safeguards and controls; and
- q unintended impacts.

The thought of genetically engineering animals raised ethical and moral concerns among participants. Visions of eugenics and "Frankenstein" were conjured along with the fear that these practices could potentially be applied.

The second and third concerns are related to some degree. There was some agreement and apprehension that a profit motive would drive the development of biotechnology applications. Participants expressed a concern that the applications would not always be beneficial to society, but would serve more narrow or even insidious purposes such as for war. These concerns led to the issue of control, which was raised in almost all the groups — "who will control this powerful technology?". A need for controls and legal safeguards was expressed. Threats were perceived to exist regardless of who controlled the technology, but it was thought that they were more likely to diminish with strict controls and government regulation.

Participants expressed a number of concerns regarding unintended impacts of biotechnology, mainly in the areas of agriculture and medicine. It was thought that biotechnology could pose an environmental threat if engineered plants mutated and then spread, unchecked, throughout the environment. The potential for unintended effects in the area of medicine also gave cause for concern. Participants cited examples of products which people had thought to be safe when in fact they were not (e.g., breast implants, thalidomide).

(b) Impact on the Canadian economy

Most participants agreed that developing biotechnology would be good for the Canadian economy. Biotechnology was viewed as being beneficial to Canadian industry and giving Canada a comparative advantage; presumably this would lead to job creation and improved product quality. Developing expertise in biotechnology would also enable Canadian regulators to adequately evaluate biotechnology products from other countries. It was hoped that Canada would apply the technology wisely and not use it for exploitative purposes against other countries (e.g., countries in the Third World).

(c) Support for Biotechnology

For the most part, a majority of participants felt that based on what they knew from their own knowledge and the discussion up to that point, the benefits of biotechnology (as a whole) outweighed the risks. Participants also agreed that they needed and wanted to know more about biotechnology in order to make a more informed evaluation.

The extent to which participants supported biotechnology was measured during recruitment and again upon completion of the group discussions; participants were asked to rate their overall support for biotechnology on a seven point scale. Participants were moderately supportive of biotechnology. Although individual pre- and post-discussion measures of support varied (e.g., some pre-measures of support increased, others decreased), there was no change in the overall pre- and post-discussion ratings of support; the average response after group discussions remained 5.4.

CHAPTER

3

REACTIONS TO SPECIFIC PRODUCTS

For each product, participants were presented with a brief description of the product and then asked for their initial impressions. Following this discussion, first the benefits and then the risks of the product were introduced. After each presentation participants were asked for their impressions of the benefits and the risks. Product deliberations culminated with a final weighting of the risks against the benefits.

3.1 Potato

Participants were provided with the following description:

A Russet Burbank potato variety has been genetically modified (through the addition of a gene) to produce a naturally occurring bacterial protein for protection against the Colorado Potato Beetle. This protein is indigestible to the Colorado potato beetle causing the beetle to stop eating.

When participants first evaluated the potato (i.e., without the benefit of an explanation of the associated risk and benefits) it did not seem overly threatening, especially if it would result in reduced pesticide use. For many people, the use of the term "naturally occurring" had a calming effect; this appeared, for the most part, to offset any concerns about the addition of a foreign gene. An exception occurred in one group, where the fact that the bacteria was naturally occurring and

commonly found in the soil made no difference; *"we don't eat soil"*. In this group, the use of the term "naturally occurring" was viewed as a marketing ploy.

A number of people, initially, expressed a positive view of the potato. For some of these people, however, this view was contingent upon the provision of further information. Some participants were incapable of placing a value judgement on this product until they had a complete picture of all the risks and the benefits. A number of people needed to know more about the product to assuage their concerns, particularly with respect to any research that had been conducted. A commonly posed question was *"If the beetle dies, what will it [the protein] do to people...If it is indigestible to beetles, might it not be indigestible to humans?"* Participants were interested in knowing over how many years research had been conducted, and whether it had been conducted on humans. Essentially, people had to know with some certainty that there were no problems associated with the introduction of the gene into the potato and that there would be no detrimental effects 10-20 years in the future.

The beetle's place in the food chain was also an extremely important concern; participants wanted to know what fed on the Colorado Potato Beetle, and whether this beetle fed on any other harmful insects. The issue of whether the Colorado Potato Beetle posed a serious enough threat to warrant such a product was also raised. For one participant, whether the beetle was indigenous to the area that the potatoes would be grown in was a deciding factor in terms of supporting the product or not.

(a) Benefits

Participants were presented with the descriptions of the following benefits:

- q It has been estimated that the Colorado Potato Beetle can destroy up to 85 per cent of a potato crop. Using this potato would result in increased yields, which would reduce costs to farmers and potentially to consumers.
- q It would also mean that there would be a reduction in the use of pesticides, meaning less pesticide in the environment and less pesticide on the potato.

- q Pesticides do not act only on the target insect, but on other beneficial organisms. The protein in this potato acts only on the Colorado Potato Beetle. The gene produces a naturally occurring bacterial protein this bacteria is commonly found in the soil.

The greatest perceived benefit of this product was the reduction in the use of pesticides. Participants were hesitant, however, to give unqualified support for the potato in the face of limited information. As long as research conducted on this product could demonstrate that the product was safe for human consumption and would not prove to be harmful in the future, this product was viewed positively. The concern expressed by participants was that not enough was known about the potential risks. There was a perception that sometimes products are released on the market before any long-term effects are known.

In addition to societal benefits, participants also saw direct benefits accruing to both the producer and the consumer. The main benefit to the producer was thought to be an increased yield. People saw direct benefits to the consumer in that they were fairly certain that the prices would drop. It was also mentioned, however, that increased production did not always lead to lower food prices because producers had always destroyed crops to control prices. A few participants noted that producers were more interested in keeping prices high than in decreasing them.

(b) Risks

Participants were presented with the following descriptions of potential risks associated with the potato:

- q There is the risk that the beetle could become resistant to the protein. This would result in the need to develop some other type of modification, because it is not possible to go back to using the pesticide.
- q There is the possibility that the plant could escape into the environment and become a "superweed" because it is resistant to one of its predators.
- q General risks about introducing new plants into the environment - tests which could identify threats might not yet exist.

The discussion of the risks tended to centre around similar concerns expressed during the initial evaluation of the product, the potential effect on the food chain as well as any cumulative effects on humans, for example. The concern that not enough was known about the potential risks was also reiterated. Participants believed that research was not conducted over a long enough period of time to fully evaluate the longer-term effects (e.g, 20 years) of such a product.

A few participants felt unable to adequately assess the risks of adding a foreign gene (naturally occurring nature of the bacteria notwithstanding) into a potato. Whereas participants had a relatively high awareness of biotechnology, this awareness was not necessarily coupled with an understanding of biotechnology. As a result, although they objected in principle to the addition of a foreign gene, some participants also indicated that it was difficult to fully assess the risks posed by such an addition.

(c) Benefits vs. Risks

The general feeling expressed in a majority of groups was that, in the case of the potato, the benefits outweighed the risks. Participants had concerns about the introduction of a foreign protein but these were alleviated to some degree by the fact that the protein was naturally

occurring and its bacterial source was commonly found in the soil. These concerns were outweighed for many by the decreased use in pesticides. Participants also understood that yields would be greater and that there would be less waste, but these were secondary issues.

A few participants hastened to qualify their support as contingent in the face of limited information. People may have been generally supportive, however, they were also wary of biotechnology because they were unable to fully evaluate all the risks. To some degree this inability arose because people did not fully understand the effects of the process employed (e.g., the effect on a potato of inserting a gene). Participants were also unable to assess risks because they believed that the research itself, conducted on such products, did not or was unable to fully assess all the risks. In terms of overall risks, some people mentioned that there were always some risks associated with advancing the state of the art.

"society has to try new things, what if no one had introduced yeast to make beer because someone else had said 'you can't do that'...You have to accept some risk in life — we are never going to go back to that natural state, but you always have to watch out".

Although a majority of participants felt that this product should be on the market. A condition for many of these participants would be to ensure that the product was identified as having been genetically modified. (A more in-depth treatment of the subject of product labelling is addressed in a subsequent section).

3.2 Tomato

Participants were provided with the following description:

A genetically engineered tomato has been developed to slow down the rate at which tomatoes soften while continuing its natural ripening process. Through the use of genetic engineering, scientists discovered that by putting a copy of a tomato gene into the tomato plant backwards, the softening process could be slowed. This gene causes tomatoes to soften and eventually spoil.

Based on the initial description, participants' reaction to this product was somewhat favourable. The reversal of the gene responsible for ripening was seen as being fairly benign as nothing foreign or unnatural was being added.

A few participants mistakenly thought that if the ripening process was delayed, the result would be a "hard tomato". The focus of discussions seemed to revolve around the shelf-life of the tomato as opposed to its improved flavour. Debates were sparked off in most groups with respect to the importance of having tomatoes that lasted longer. Some people felt that it was not an important feature because they did not currently experience any problems with "tomatoes rotting in their refrigerators": *"if you don't buy too many, they don't rot"*. Other participants expressed interest in not having to worry about whether or not their tomatoes would last long enough.

(a) Benefits

Participants were presented with the following benefits:

- q Because ripening (softening) is delayed:
 - q the tomato has a longer shelf life; and
 - q the tomato spends more time ripening on the vine:
 - q enabling them to develop their natural flavour, so that they taste better;
 - q they have more nutrients; and
 - q they also have better colour.
- q Currently, tomatoes are picked green and sprayed with ethylene gas (synthesized) so that they turn red in crates during transportation, whereas the Flav'r Savr is picked only once it has ripened. The result of current methods is a red tomato that tastes "green". (Note to moderator: ethylene is a gas that tomatoes emit as they ripen).

Opinions were mixed with respect to whether the consumer or the producer would benefit the most from this product. Some people thought that the consumer was the primary beneficiary because the tomatoes would taste better, last longer, look better and contain more nutrients. Other participants felt that the producer benefited the most because they would be able to sell more tomatoes. They noted that producers rarely "produce" simply because it benefits the

consumer; they engage in production because it benefits the producer. It was also recognized, however, that if a product did not have some benefit to the consumer, the consumer would not purchase it and, hence, it would not be profitable to the producer.

A few people in most of the groups questioned the necessity of this product; "*it seems like a lot of trouble to go to for a tomato*". Other participants challenged the product's utility on economic grounds. The advantage of producing this tomato was brought into question. They felt that such a product would only be necessary in the face of a shortage of fresh tomatoes, which they did not think existed. For these people, this product lacks appeal mainly because its attributes are not deemed essential. In contrast, other participants found the product attributes appealing; they could relate to, even look forward to, the idea of better tasting tomatoes in the winter.

In a few groups, the question of Canadian production arose. Participants were more likely to view this product favourably if the benefits accrued were to *Canadian*, as opposed to American, producers.

(b) Risks

Participants were similarly presented with the following descriptions of potential risks associated with the tomato:

- q General risks about introducing new plants into the environment - tests which could identify threats might not yet exist
- q To know that the process of reversing the gene was successful, the developers also attach a "marker" gene.

This marker gene is an "antibiotic gene"⁴. The argument is that there is a growing intolerance to antibiotics and having an antibiotic marker gene in a food product can only aggravate this problem. Research, however, has failed to prove that marker genes can pass from food to bacteria in a person's stomach. As well, this antibiotic is not used on humans or animals, so there is no worry of becoming resistant to something that is used.

The addition of the "marker gene" was the apparent Achilles heel of the tomato. Some people reacted quite strongly to the "marker gene", others didn't overly object. For at least one person, the addition of an additional gene was cause for suspicion; *"would it then mean that other things might also be added without consumers' knowledge?"*. As something foreign was being added to the tomato, some participants' first reactions were to ask whether research had tested the effects of this gene on humans.

To some degree, participants found these risks too difficult to evaluate; they thought that even scientists were not capable of fully assessing consequences; *"history has provided many examples in the past 20-30 years to make a person extremely sceptical"*. It was further believed that there were also previous examples in which insufficient research had been conducted in the assessment of risk. This was viewed mainly as a direct result of industry pressure.

"Sometimes the people conducting the research are funded by the producers (who have little interest in safety issues). I don't think that the government has the money to fund the necessary research, so it is probably the producers and they may not be comfortable with it (i.e., some of the findings)"

A general concern about the environment was also noted, particularly the risk associated with the introduction of new plants. A number of people mentioned the adverse effects of introducing something new into an ecosystem, particularly if the plant has no natural predators.

4. The marker gene is in fact not an antibiotic gene, but a gene that provides resistance to a specific antibiotic. It is inserted together with the "reversed ripening" gene to distinguish successful attempts to modify the tomato from unsuccessful ones. When the cells which are thought to be modified are exposed to the antibiotic, only those cells containing the marker gene — and therefore those with the successfully reversed ripening gene — survive. It should be noted that the information on the antibiotic gene was added after the initial groups in Toronto, and so was not presented in two of the eight groups.

(c) *Benefits vs. Risks*

Most participants felt that the benefits outweighed the risks. In a few groups the vote was split fairly evenly (i.e., about one half felt that the benefits outweighed the risks, the other that the risks outweighed the benefits). For those who felt that the benefits outweighed the risks, the deciding factors included the following:

- q the larger issues associated with producing more food;
- q having tomatoes last longer and taste better in the winter; and
- q a hope that research would identify and eliminate any of the risks so that the benefits would outweigh the risks eventually.

Although participants expressed some support for this product, as with the potato, there were also some concerns about the unknown effects associated with it; a fear of the repercussions of "fooling with mother nature".

Health fears were the main reason for not wanting to see the tomato on the market. For some, biotechnology agri-foods products are equated with "unnatural foods". Participants felt that more research, conducted with human beings, was required before it was put out on the market.

For those participants for whom the risks outweighed the benefits, the use of the marker gene was the over-riding factor in their evaluation. The genetic engineering process (i.e., the reversal of the gene) was accepted but the addition of the "marker gene" was not. The scientific arguments supporting the use of the marker gene (i.e., the lack of any evidence indicating possible adverse effects) had little effect. Some participants balked at the thought of an "antibiotic gene" being inserted in their food.

For biotechnology products such as the tomato, some participants felt that the greatest risks and benefits did not accrue to the same individual. It was believed that the individual ingesting the product faced the greatest risk because of the chance that the product might be identified 10-20 years hence as a carcinogen. In terms of benefits, the producer and the developer of the technology

were thought to benefit the most from the product, whereas benefits to the consumer (e.g., better taste) were relatively modest; *"the benefits to consumers are marginal and the benefits to the producers are substantial whereas the risks to the consumer are substantial and the risks to the producer are minimal"*.

A number of people mentioned that they would be interested in seeing the tomato on the market and indicated that they would purchase it if it were available. Price, however, was an issue, some people would not pay more for it, others would pay only a slight premium.

"Yes I am interested in seeing it on the market because the benefits outweigh the risks. If it is a reasonable price I will buy it. This product should exist if it totally benefits the consumer and if the effects don't hurt the consumer. We also have to ask whether or not we need the product, are there some countries which might need it more? Personally, I would buy it if it tasted better and were more nutritious. I would also need to know that it had been approved for consumption."

There was spontaneous agreement among participants that it was important for consumers to be able to differentiate this tomato from non-genetically engineered tomatoes. People would be interested in the introduction of this product on the market, in principle, if it were labelled. Even participants who were generally opposed to the tomato were supportive of its introduction in the marketplace. These participants acknowledged the rights of other consumers, who were interested in consuming the tomato, to be able to do so. They also, however, wanted to be able to exercise their rights (i.e., that of not consuming the product); differentiating this tomato from other non-genetically engineered tomatoes was viewed as the only way of accomplishing this (i.e., ensuring that they would not accidentally consume something they wanted to avoid).

For some people, shelf life was not a motivating factor. Similarly, they did not regard having summer fresh tomatoes in the winter as being important. *"How often do you eat tomatoes, couldn't you have come up with a better food, something that you use everyday?"*. The underlying consideration is that this product was perceived by participants as being somewhat trivial because it was not viewed as having solved a problem. *"Biotechnology hasn't really solved anything — we were eating tomatoes fine before — what have they done?"*.

3.3 Societal vs. Direct Benefits

One of the study issues concerned whether consumers attach more weight to personal (i.e., direct) benefits or to societal (i.e., indirect) benefits. The tomato and the potato were selected to be reflective of these two types of benefits: the tomato was intended to be illustrative of direct consumer benefits, whereas it was thought the benefits of the potato were illustrative of societal level benefits. Not surprisingly, participants did tend to see societal level benefits with the potato rather than with the tomato. For some people this was the factor which caused them to give greater support to the potato. When compared to the facilitation and augmentation of agri-food production, modifying tomatoes appeared almost frivolous to participants.

Two groups tended to react better to the tomato than the potato, mainly because it was seen that nothing foreign was being added to the tomato. Participants in these particular groups, however, were not presented with information about the addition of an antibiotic marker gene. It is possible this additional information might have changed the response of these groups.

When participants considered both the tomato and the potato, upon first evaluation, both products appeared satisfactory: nothing foreign was added to the tomato and the addition of the protein to the potato was offset by the reduction in the use of pesticides. Many respondents, however, needed to know what kind of research had been conducted in order to ensure that these products were safe, (e.g., who had conducted the research, whether they had been tested on humans and over what period of time).

The description of benefits and risks of the potato seemed to reassure participants, whereas a similar exercise with respect to the tomato gave many cause for concern. Although a number of people indicated initial support for the tomato, after deliberation of the benefits and the risks support for the tomato tended to erode; in this case participants felt there was little societal benefit to counter any personal risks.

CHAPTER**4****INFORMATION NEEDS**

In each of the product discussions, following the discussion of benefits and risks, participants were asked in a general manner, about their information needs. Their responses pertain to the three following areas:

- q identification and labelling;
- q point-of-sale information; and
- q public education.

4.1 Identification and Labelling

The issue of labelling surfaced spontaneously in all group discussions: in response to the general question as to what information they needed, a majority of participants indicated that they would like to be able to identify genetically altered food.

People expressed a need to know whether a product had been modified in order to exercise personal choice; specifically whether the modification had been genetically engineered. The important issue was identification, not extensive, detailed labelling. In this vein, people spoke of signs and logos as being sufficient. Some people noted that logos would be preferable to detailed labelling since it was believed that many people did not read labels, and therefore, would remain oblivious to the alteration. Where logos were proposed by participants, it was recognized that they would have

to be commonly understood. An adequate explanation of the logos would have to be provided during initial introduction of the product (e.g., point of sale information or public education).

Once the issue of labelling had been raised by participants, they were probed further on the issue. Participants were asked how they would feel if these products were introduced on the market without any identification. A number of people were non-committal. Others conveyed an "oh well that's life" attitude. These latter participants noted that there were probably many things in the marketplace that they as consumers were not informed about.

In contrast, some participants (comprising a minority of labelling advocates) felt very strongly about the issue⁵. These participants indicated they would be upset and would feel a sense of injustice if the government decided not to require that genetically altered products be differentiated. In terms of how they would react, responses were mixed. A few participants said they would feel troubled enough to write a letter to their Member of Parliament, whereas others, although angry, would feel powerless to do anything about it.

"Not having the ability to make the choice? I'd place that as an 8.5 to 9 out on a 10-point ticked off scale. The government makes a lot of choices for you and they have to, but they shouldn't make too many with your food because you have to feed it to your kids"

(a) Rationale for Labelling

Participants' reasons for requiring labelling centred around three main themes: the issue of choice; health issues (e.g., the emergence of food allergies); and greater food safety.

Many participants felt that personal choice was an individual right. In order to exercise that right, people first needed to know that a product had been modified. If the government

5. An exception to this occurred in one group, in which 7 out of 9 participants felt very strongly about labelling when probed.

authorized the non-identification of genetically altered products, it would be seen as removing a fundamental right.

The need for choice tended to be linked to health issues; people said they needed to satisfy themselves that the food was safe before they would consume it. If, for example, some people believed that genetically altered products posed some health risk, participants said these people would need to be able to identify the products in order to avoid them. The increased occurrence of food sensitivities was also cited by participants as a reason for promoting labelling; people with existing food sensitivities were viewed as being particularly at risk.

Related to the health issue was the argument that recent history had confirmed, in the view of participants, that government regulators were not infallible when it came to product safety decisions. Participants also noted that industry could not be trusted to follow a course of action which would adversely affect their profits. In the absence of labelling they noted that consumers would be solely dependent upon "fallible" government regulators' decisions and what they viewed as the questionable reputation of industry for the safety of the products they consume. Some participants viewed labelling as a step in enabling them to make informed choices, rather than depending on government and industry decisions.

A few participants also believed that labelling somehow forced the developers of the technology, as well as the producers, to be more careful; labelling seemed, to them, to make industry more accountable. It may be, in the minds of these participants, that the imposition of labelling standards creates a more open operating environment in the biotechnology industry (as opposed to a secretive one in the absence of labelling regulations). One participant further remarked "*if (biotechnology) is so positive, if it is safe, then why not tell people about it?*".

(b) Regulatory Approval and Labelling

Participants were asked whether they still considered labelling necessary. Although it was important for participants to know that Health Canada had approved a product, knowledge of Health Canada approval did not eliminate participants' desire for labelling. Health Canada approval

was sufficient for a few participants, but most participants still wanted to be able to identify genetically altered products in the market place. The regulatory track record of certain products (e.g., thalidomide) was cited as the main reason.

The notion of government approval being sufficient was also rejected on the grounds that the issue is one of choice, not just safety. Participants who intended to purchase genetically engineered products as well as those who did not, both agreed that, in principle, consumers need to be able to exercise choice.

(c) Other Labelling Issues

Participants were probed in some depth with respect to some of the other issues associated with labelling in order to determine the impact of these issues on how strongly participants felt about labelling. Groups were asked to consider the larger issues associated with labelling, such as increased cost to industry due to ingredient tracking, a possible loss of Canada's competitiveness if labelling were not required in other countries, harmonizing with international standards, etc. Only a few participants regarded these factors as important considerations in the labelling debate. Most people did *not* believe that these factors were something that they (as consumers) needed to resolve; in their view industry and/or government should address them.

When asked how far they expected industry to go in terms of mandatory labelling of genetically engineered products some participants mentioned that there were logical limits to the issue. For example, it might not be reasonable to expect to know what one was eating in a restaurant. Some people also realized that it might be complicated for manufacturers to keep track of biotechnology produce throughout the manufacturing process.

Most participants, however, still wanted to know if any part of the food they bought in a store had been altered. Again the issue of allergies was raised to substantiate this point. Others simply refused to believe that it was onerous for companies to keep track and provide this information, especially if a simple logo (e.g., "GE" for Genetically Engineered) could be used.

With respect to the cost issue, some participants took the view that producers should absorb any costs associated with the labelling because the new products would presumably yield either some cost reduction or increased revenues to producers. They mentioned that if the products did not yield these benefits, the utility of any biotechnology product was brought into question: *"why produce the product in the first place, why not just stick with the original product"*.

Some participants indicated that both the government and industry had responsibilities (albeit different ones) to the public. If consumers needed all genetically engineered products to be labelled, the government should impose mandatory labelling. Biotechnology products and applications were viewed by participants as a proposition by industry to the consumer, therefore, it was industry's responsibility to take whatever measures were necessary to make these products acceptable to consumers (e.g., labelling).

Some people also pointed out that the "trend" in consumer products was towards increased information on labels, not less. Some participants believed that the US had more labelling information than was currently the case in Canada, therefore, arguments which claimed that there was not enough room on the label, rang hollow. The proposition of adding "may contain" on a label was deemed insufficient because it was viewed as self-defeating; all products would probably have the "may contain" identifier thus nullifying the intent of the label.

It is important to note that on occasion, other participants challenged the labelling advocates on a number of grounds. The idea, for example, of acceptable risk was raised: *"we take risks everyday, it is simply a question of what is acceptable risk"*. Linked to this was the notion that people do not really know what they are eating now (e.g., chemical treatment such as the use of pesticides, preservatives and additives in food products). Some people were not swayed by this; for these people, the main issue was genetic manipulation and, they pointed out that chemical treatment did not constitute such an alteration of the product.

4.2 Point-of-Sale Information

Point-of-sale information was viewed as being most effective during the introductory stages of a product. The addition of a 1-800 telephone number was also viewed as beneficial because people's information needs varied — those for whom detailed information was important could access it through the 1-800 number. It was believed that many people might not look at labels nor question what was in the supermarket. People must, none-the-less, have the ability to find out more information easily if they need to.

4.3 Public Education

In addition to point-of-sale information, participants also indicated a desire for some form of public education campaign; government and then industry were mentioned most often as possible sponsors. Public education was advocated for two main reasons, first because it made "good sense" and second because it would help consumers process any point-of-sale and labelling information.

From a public policy perspective, participants argued that it simply made good sense for the government to bring the public up to speed on a technology that would eventually have a daily impact on their lives. It was also noted, in at least one group, that an education campaign might be beneficial to both government and industry because it would inform people of the "impressive progress" which was being made in this area. Public education would also serve to reassure Canadians that the government was evaluating these advances.

"It would show me that the government has been active in doing useful work. It would also reinforce the notion that they were paying attention to the issue and thus help allay fears that unsafe products might be getting through undetected."

A public education campaign would assist in raising the public's understanding of biotechnology. It was believed by some participants that many people did not read labels, and further, they might not understand what was meant by "genetically modified". Public education was viewed as enabling consumers to make informed choices. This reinforces what was expressed in an earlier

discussion of the risks associated with products. In order to process product information and adequately assess the risks of biotechnology, some people will require more information.

"Maybe it comes down to the unknown — we don't really know how it changes things. When I think on it, I guess that I think of some kind of radiation sickness...Despite what I have said, I'm very pro science".

"Biotechnology kind of scares me because I don't really know that much about it, and you hear things...I worry sometimes that we mess around with things too much. So as somebody who doesn't know a lot about this, it scares me".

4.4 Sources of Information

Generally, the government and universities were viewed by participants as being the most likely sources of information; they were also viewed as the most credible sources. In some groups government and universities were viewed as being credible because they were thought to be the only organizations possessing information on biotechnology. Non-government organizations (NGOs), such as consumer advocacy groups, were also mentioned as a potentially credible source.

To some degree participants' perception of credibility is more reflective of a choice among unappealing options, as opposed to any singular confidence in these institutions. Some people remarked that *"you can't take the word of government as gospel, but what choice do we have?"* There was a general view that government did their best to oversee issues such as this, however, it was questioned whether it would be enough to protect people (e.g., Red Cross blood supply issue). The credibility of university research was also brought into question as it was noted that universities' research would, increasingly, be funded by industry. Government funded university research was perceived as being more credible, than industry funded research.

The key issue in all groups was for *objective* research to be conducted. Some participants expressed doubt about the extent to which anybody could have sufficient knowledge about a technology that was so "leading edge". Participants wanted to see objective scientific research. They were wary of groups who had a stake in the product and indicated concern over how

lobby and pressure groups operated. They also noted that, on occasion, researchers were beholden to other organizations (e.g., business) to fund their research. In participants' view, neither of these two situations would be conducive for the conduct of objective research.

(a) Implications for Improving Credibility of Information

Some people were attracted to the notion of a number of organizations, representing assorted interests such as NGOs, government, universities and industry, coming together to address some of the issues surrounding biotechnology. These organizations could form, for example, a panel or a committee. Participants mentioned a number of functions that such a group could serve, including the following:

- q advisory (e.g., advising the public on issues surrounding biotechnology);
- q provisory (e.g., providing information to the public);
- q monitoring (e.g., monitoring the approval process); or
- q participatory (e.g., participating actively in the approval process).

The latter two functions (e.g., monitoring and participatory) were mentioned by a few participants who viewed them as a compromise in the absence of mandatory identification of genetically engineered products. The important consideration for participants was that divergent interests would be represented in such multi-interest groups.

Underlying the concept of the establishment of panels or committees was participants' view that the research needed to be unbiased and not funded by organizations with a vested interest in the results. Aware of the competing interests of NGOs, industry, universities and government, participants felt that if people with competing interests could present a unified message or come to some agreement regarding biotechnology, the information conveyed would be credible to them.

CHAPTER

5

SUMMARY OF KEY FINDINGS

Awareness and Understanding

Awareness of biotechnology was fairly high: three-quarters of participants had heard of the term biotechnology with an even greater number of participants showing awareness of one or more specific biotechnology applications. Biotechnology was linked with high tech, agri-food and medical applications. Although some participants had virtually no knowledge of biotechnology, most people were moderately familiar with a few having fairly sophisticated knowledge.

Although awareness is high, it is not accompanied by much understanding of the technology. To some degree this lack of understanding limits participants' ability to fully evaluate risks and is one source of their desire for public education.

Perceptions

When considering all areas of application for biotechnology as a whole, the benefits were generally seen to outweigh the risks. Most participants agreed that developing biotechnology would be good for the Canadian economy. Some of the advantages noted during group discussions include the following:

- q increased comparative advantage for Canada;
- q job creation;
- q improved product quality; and
- q increased ability to evaluate other countries products.

Biotechnology was viewed in broad terms, including a propensity to recognize societal benefits in addition to or instead of more narrow personal benefits. People were swayed more by the potential for positive societal level contributions, medical applications, for example.

Strong concerns were also expressed regarding biotechnology. Ethical and moral considerations, as well as the issues of control, safeguards and unintended impacts were strongly voiced. This indicates that people are able to see the broader implications of the technology and are not disposed to completely dismiss the technology as a result of their concerns. Biotechnology was not viewed as being intrinsically harmful; however participants noted that there could be dangers associated with biotechnology, depending upon how the technology was applied.

Although individual pre- and post-discussion measures of support varied (e.g., some pre-measures of support increased, others decreased), overall, participants remained moderately supportive of biotechnology; ratings of support remained 5.4 (on a seven-point rating scale) after group discussions.

Risk-benefit trade-offs

The presence of societal level benefits was a deciding factor in the evaluation of specific products used as examples of different types of benefits (e.g., direct vs. societal benefits).

When participants were asked to compare the two products, they saw greater societal benefits associated with the potato than with the tomato; for a number of people the presence of societal level benefits was the factor which caused them to give greater support to the potato. Unlike the potato there was little societal benefit associated with the tomato to counter any personal risks associated with consumption.

Information needs

A majority of participants spontaneously expressed a clear desire for the labelling of genetically engineered products. In their view, the issue of product identification stems from the need for personal choice and the belief that it is a personal right. Knowledge that food products had been approved was not enough. When probed further, a minority felt strongly enough about the issue to say that they would write a letter to their Member of Parliament if they became aware that products had been introduced on the market without such labelling. The stronger advocates of labelling refused to believe that it would be particularly onerous for industry to track ingredients in their production process, but felt that if this were a problem, it would be one for industry and government to resolve.

Participants also expressed a desire for point-of-sale information (particularly during a product's introductory stage) and some form of public education campaign to raise the public's understanding of biotechnology. The key issue associated with the provision of information is that it is necessary in order for consumers to make informed choices.

Credibility of Sources

Government and universities were viewed as the most credible sources of information about biotechnology, mainly because they were the least unappealing options. NGOs such as consumer advocacy groups were also noted. Industry was not viewed as credible because of vested interest.

Some people were attracted to the notion of a number of organizations representing assorted interests (e.g., government, industry, universities, advocacy groups), coming together to address issues surrounding biotechnology. Participants viewed the establishment of a group with diverse representation as providing an internal set of checks and balances; information communicated from audited group would be perceived to be credible.

CHAPTER

6

IMPLICATIONS OF FINDINGS AND
AREAS FOR FURTHER RESEARCH

6.1 Implications

Although awareness of biotechnology is high, it is not accompanied by much understanding of the technology. To some degree, there is a measure of fear and/or discomfort that is accompanied by a lack of understanding about biotechnology. This is evidenced by the fact that some participants felt unable to make an adequate evaluation of the risks and benefits — they simply did not know or understand enough about the process to be able to make an informed judgement. This lack of understanding is also one source of their desire for public education.

Simply educating people about biotechnology will not, however, necessarily increase their comfort level with the technology nor with specific applications. It is, however, a necessary first step. Education alone will *not* reassure people that the product has not changed in some unexpected way, *nor* will it reassure them that all the possible consequences have been carefully evaluated (e.g., it has been determined that the Colorado Potato beetle will not be eradicated and that the food chain will not be adversely affected in some unintended way). These types of concerns are more likely to be dispelled by rigorous, credible, (biotechnology) application-specific research.

Education may help to dispel concerns relating to the effects of the genetic process employed (e.g., what the effects of inserting a gene into a potato are; the extent of the change). Once

consumers have familiarized themselves with the technology, however, they will also need to have access to credible information.

There was a great deal of scepticism expressed regarding the propensity of industry to engage in an activity which would hurt their financial bottom line (e.g., engage in the more costly — and hence less profitable — longer-term research which would reduce the risks to consumers of potential adverse effects of products) as well as the ability of government to withstand pressure from aggressive multinationals to ease up on regulatory restrictions.

Although government and universities are probably viewed more credibly than other sources of information, the most credible forms of information would come from a group with representation from organizations which had competing or diverging interests (e.g., government, industry, advocacy groups, universities). Consumers want balanced information; they need to know all the pros and the cons in order to fully weigh the risks and the benefits.

As noted, the benefits of biotechnology were generally seen to outweigh the risks. In terms of trade-offs, perceived risk is more likely to be offset by benefits perceived as accruing to society than by any direct consumer benefits. The main appeal of biotechnology are the broader or long-term possibilities; support has little to do with the immediate possibilities for consumer benefits.

That people tend to focus on the broader benefits of biotechnology should be considered carefully; caution should be exercised in the application of this finding. It might not, for example, be appropriate to use it in the estimation of the relative market demand of products exhibiting societal and direct benefits. Although people can say that these factors are important in weighing risks and benefits, it should be recognized that they may not in practice be featured so prominently during decision making in the market place. From a communication or public education perspective, however, it is an important consideration to note.

One of the strongest messages to emerge from the focus groups conducted for the project was the issue of process identification. People feel that they should have the right to choose whether they will consume genetically engineered products, particularly in the face of a new technology with limited information.

Explanations of limited space on labels and the complexity of ingredient tracking have little influence on perceptions. The stronger advocates of labelling refuse to believe that it is particularly onerous for industry to track ingredients in their production process. The reason for this steadfast belief may be due to an incomplete understanding of the complexity of the issue of ingredient tracking. It is also possible that the issue of personal choice is so strong that labelling is viewed as one of pre-conditions, regardless of the costs, for the introduction of genetically engineered products.

As many people may not have sufficient understanding of biotechnology to adequately process labelling information, labelling also needs to be accompanied by point-of-sale information (including a 1-800 number) and a government sponsored or assisted public education campaign. The key issue associated with the provision of information is that it is necessary in order for consumers to make informed choices.

6.2 Areas for Further Research

The intent of this project was to provide additional information in order to achieve better understanding of public perceptions of and attitudes towards biotechnology applications, specifically with respect:

- q what consumers know about biotechnology;
- q consumer reactions to specific genetically engineered products including trade-offs among the potential risks and benefits; and
- q consumer information needs and perceived credibility of experts.

These three areas, as identified in the Research Design, were addressed in the current project. The role of government had also been identified during the Research Design. Limited, however, by the amount of information which could realistically be collected during a two hour group discussion, the role of government was not addressed in-depth. Little is known about whether the public understands what roles the government currently undertakes in the area of biotechnology. During focus groups, some participants believed that the government actively engages in extensive direct research as opposed to reviewing studies conducted or commissioned by developers of biotechnology products. The general public may only have a vague notion of what the government's

roles and responsibilities are in the field of biotechnology, which can affect their perceptions of the effectiveness of the government in this field. Issues which have not been addressed include: consumers' perceptions of government roles in research, regulation and the provision of information; and the extent of government involvement consumers desire.

One of the key research gaps identified in the Research Design was the general public's actual knowledge and understanding of biotechnology. Although knowledge levels were assessed during this project, the relative impact that knowledge of biotechnology has on the decision making process was beyond the scope of this project. Such an exercise would require a more quantitative treatment; quantitative measures of knowledge of biotechnology as well as various attitudinal and socio-demographic variables would have to be modelled together.

Most participants expressed a need to know that a product had been modified. Although participants were probed in some depth regarding the issue of labelling, discussions on the topic were limited by the amount of time available. Based on group discussions, it is not clear whether participants had an incomplete understanding of the complexity of the issue or whether the issue of personal choice is so strong that labelling is viewed as one of pre-conditions, regardless of the costs, for the introduction of genetically engineered products. As a full description of all the issues was not presented to participants, additional focus groups could be held, focused only on the issue of labelling. Reactions to examples of the kind of information consumers might expect to see on labels could be obtained.

A number of information packages explaining biotechnology should be focus group tested. As participants expressed a desire for further information about biotechnology, various information packages should be tested for effectiveness. The credibility of various sources should also be examined along with the explanations of biotechnology. Exploring the impact of explanations and source credibility on perceptions of biotechnology could also be considered.