

The Marketing Battle Over Genetically Modified Foods: Consumer Acceptance of Biotechnology*

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Abstract

On the biotechnology battlefield, proponents try to sell the benefits of genetically modified foods, and opponents try to sell the risks. Yet for both camps, oversimplified assumptions about consumers have led to counterproductive strategies and tactics. For instance, proponents assume the biotechnology issue will “blow over” and that good science sells, while opponents assume that consumers want to be informed, and that risks of the unknown are more important than benefits. Based on an understanding of consumer behavior, eight assumptions of proponents and opponents are examined and revised. The resulting insights point to specific changes that both proponents and opponents of biotechnology can use to more effectively educate their constituents.

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Proponents of biotechnology would like us to think that the challenges faced by Henry T. Ford are not unlike the challenges facing the biotechnology industry today. Road commissioners and horse breeders were probably not pleased when the Model T rolled off the assembly line. Yet when society looks back at the Model T revolutionized their lives, the view is positive. But selling biotechnology is very different than selling cars. Instead of building up speed, biotechnology is finding the road is increasingly crowded with confused consumers and with skeptics who want to know more before they will allow biotechnology to progress.

Both proponents and opponents of biotechnology argue that their goal is to educate consumers so they can make informed decisions. While opponents focus on educating consumers about the risks of biotechnology, proponents focus on the benefits. Yet if we consider education as an objective, neither group has been decidedly successful (Doyle 2000). The thesis of this article is that part of the ineffectiveness of these efforts are because of the inaccurate assumptions both opponents and proponents of biotechnology have about consumers. This leaves their efforts often misdirected or weakly leveraged.

Proponents of biotechnology have based their marketing campaign around key assumptions about the consumer that is reflected in the way they communicate. Many of these assumptions are based on the years of familiarity with “market share advertising” and a commodity promotion mindset. Such expectations self-limit their effectiveness by leading them

to assume 1) The biotechnology issue will “blow over,” 2) once consumers have the facts, they will be biotechnology advocates, 3) science sells and fear fails, and 4) biotechnology is an industry issue

Opponents or skeptics of biotechnology do not make these same mistaken assumptions. Instead, while their guerilla campaigns may have gotten attention, these strategies are rooted in grassroots experiences that lead them to make different counterproductive assumptions about consumers. Their efforts show that they assume, 1) Consumers want to be informed, 2) consumers need to be informed, 3) changing consumer attitudes will change their behavior, and 4) risks of the unknown are more important than benefits.

Using key principles of consumer psychology to reexamine these assumptions will enable both groups become more effective in educate the consumers they wish to reach. After outlining a basic model of consumer decision making, this chapter then uses these principles and others to revise the eight limiting assumptions that both proponents and opponents of biotechnology make about consumers. Following this, ideas are provided for how biotechnology education and safety concerns can be addressed by both groups in the future.

How Consumers Form Attitudes Toward Biotechnology

Consumers’ attitudes toward biotechnology are divided. A recent study (Doyle, 2000), showed that 31% favor biotechnology, 18% oppose it, 26% have mixed feelings, and 26% neither know nor care. Even within each of these groups, their opinions are as diverse as the people expressing them (see Table 1). The differential acceptance of genetically modified products among consumers can be attributed to the different ways in which they process information about biotechnology and related products. Some people carefully weigh potential

benefits more heavily than risks. Others form their biotechnology attitudes solely based on “sound bites” they hear on TV or at work.

[Insert Table 1 Here]

Regardless of what attitude a person has toward biotechnology, there are two general ways or routes in which they are persuaded and their attitudes formed: A central route to persuasion and a peripheral route to persuasion (Petty & Cacioppo, 1981; 1986b; 1978). When a person is motivated to understand an issue, when they have the ability to understand the issue, and when they have the opportunity to do so, their attitude will be formed through a central route of attitude formation. If, however, a consumer is not motivated to understand the issue, or if they do not have the technical or cognitive ability, or the opportunity to think about it, any message they hear will be peripherally processed. It is important to understand how central and peripheral processing influence attitudes before assessing the effectiveness of marketing and education efforts. Figure 1 illustrates the two different routes of forming attitudes towards biotechnology and some of the factors that influence the resulting attitudes along the two paths.

[Insert Figure 1 Here]

The Central Route to Persuasion – Trading-off Benefits and Risks

When attitudes are centrally formed, a consumer’s attitude toward biotechnology is determined by the beliefs about various characteristics of biotechnology weighted by the evaluation of the importance of each belief [Attitude = $\sum (\text{Belief}_i * \text{Importance Weight}_i)$] (Fishbein & Ajzen, 1975). The resulting attitude is the net effect of all positive and negative

beliefs about the target weighted by their importance. Because beliefs are subjective, they are not always correct and they can vary dramatically across consumers. In addition, the importance weights given to specific information or beliefs can vary across people even if they share some common beliefs. These differences can lead to two people with very similar experiences having different attitudes toward biotechnology.

Recent studies have shown that consumers generally view genetic engineering technology as a risky process (Sparks et al 1994; Wohl 1998). However, if the genetically modified products offer benefits that traditional products can not offer, perceived benefits outweigh the perceived risks related to genetic engineering technology. Table 2 summarizes the perceived benefits and risks involved in biotechnology.

[Insert Table 2 Here]

The Peripheral Route to Persuasion and the Silent Majority

When consumers have little motivation to process biotechnology information, or little ability to understand it, or no time to digest such information, their opinions will be influenced by the peripheral route to persuasion. Sometimes this happens simply because the information is either too detailed, or because it is too general to integrate into a belief system. In other words, it is either too complex or too general. For instance, while risks from microbiological hazards are reported in quantitative terms (i.e., number of occurrences and percentage increase or decrease), risks from food applications are generally stated using unqualified terms such as “bad” and “thus should be avoided” (Frewer, Raats, and Shepherd 1993).

This lack of access to information combined with lack of ability to process complex biotechnology information is likely to lead most consumers to engage in more heuristic

peripheral processing when forming attitudes toward biotechnology. When the peripheral route is activated, the focus is not on message arguments but non-message cues, such as public opinion, sound bites, emotions generated by advertising, labeling, or the credibility of spokespeople or endorsers.

This general notion that people can be aware of an issue without having specific knowledge of it is well-supported. Sheehy, Legault, and Ireland (1998) reported that consumers, even highly educated ones, had little or no *knowledge* of biotechnology. However, their *awareness* of biotechnology, defined as “having heard of the term,” was substantially high. This high awareness/low knowledge scenario is particularly common with biotechnology (particularly genetic engineering) because it is new, complex, and not evident to the casual observer. Therefore, consumers can be aware of a biotechnology application while making no associations between it and the genetic engineering process that created the novel characteristics.

Marketing Fallacies of Biotechnology Proponents

Regardless of one’s position, effectively educating consumers about the benefits and risks of biotechnology, necessitates having the proper assumptions about how consumers learn. To date, both opponents and proponents of biotechnology are operating under assumptions about consumers that limit the effectiveness in communicating their message to the public. To be more effective, each of these assumptions must be revised. Table 3 summarizes some of these assumptions and the accompanying changes that should be made to make marketing and education efforts more effective.

[Insert Table 3 Here]

Proponent Fallacy #1. The Biotechnology Issue will “Blow Over”

Should the earlier metaphor of biotechnology being the Model T of the 21st century prove right, it will only be because it stays on the road long enough to outlast resistance. Some highly visible companies (consider Taco Bell and McDonalds) have bowed to biotech pressures to source select non-GMO food. Nevertheless, the biggest concern here is the problem we do not see.

A content analysis of stories about biotechnology have shown a balanced reporting of the topic over the past 10 years. Yet, the earlier years tended to be more positive than the later years. The common hope that this is a topic that will “blow over” was an fatal error made by the British. In 1994, public sentiment toward biotechnology was neutral if not moderately positive. The industry, therefore, took no real efforts to build public support or enthusiasm for biotechnology because attitudes toward it were improving each and every day. Attitudes were favorable, but neither fully formed nor stable. As a result, when “mad cow disease” became an issue, the industry had not generated the appropriate level of education and support needed to keep the issue in perspective and to keep biotechnology moving forward.

This is true with the United States. Perhaps sentiments of the non-vocal majority are moving ahead at a pace that would indicate this whole issue will blow over. The concern, however, is that we are only one “mad cow disease” episode away from losing the biotechnological ground that’s been gained. Because of the highly sensitive nature of this issue, it is critical to “shore up” an understanding of biotechnology and attitudes toward it so that an uncontrollable, or unrelated event would not unnecessarily cause a fatal overreaction.

Current negative public opinion about the use of biotechnology, especially in food industry, is largely due to the uncertainty that stems from lack of information by the public. In addition, biotechnology rapid advancement and some of the current safety issues may become

non-issues. In the case that current negative public reaction to the use of biotechnology is temporary, as was the cases for other innovative technologies such as electricity and computers, marketing strategies should focus on counteracting public misperceptions and educating consumers about the benefits of biotechnology. The main task is to accelerate consumer acceptance through the use of more effective persuasion strategies.

Conversely, controversy over safety and ethical issues involved in the use of biotechnology may be a persistent problem and continue to haunt all parties involved even after the majority of the consumers have adopted the products. Adaptation in living organisms and their change is neither completely predictable nor completely controllable. Therefore, in the long run, the biotechnology industry and researchers as well as the government should try to safeguard potential hazards. First, objective measures of potential risks of hazards involved in biotechnology and biotechnology products must be developed. Without such measures, it will be impossible to convince consumers of the safety of biotechnology. Secondly, legal and self-regulatory protection devices must be strictly reinforced by government and industry. Lastly, and the most importantly, codes of ethics that guards against the potential misuse of biotechnology must be established. Although some groups have issued such codes, candid acknowledgement of the potential hazards of the technology and sincere concerns for human well-being by researchers and the marketers of biotechnology and its products are required to safeguard potential hazards.

**Proponent Fallacy #2. Science Sells and Fear Fails:
Once People Have the Facts, they will be Biotech Advocates**

Consider the case when a person's attitudes have been formed through the peripheral route to persuasion. With relatively low awareness and knowledge of biotechnology along with no established measures of benefits and risks involved in biotechnology applications, his or her biotechnological attitudes will be susceptible to the influence of other people's opinions and reactions and peripheral events. To this person, careful scientific reports and expertly articulated third party testimonials will have little if any direct impact. Indeed, even a judicious FDA endorsement might have little impact compared to a sound bite or to the negative portrayal of genetic engineering applications in a movie.¹

Perhaps the biggest indicator of how low involvement sells is in looking at how social and ethical taboos play a great role in generating public concerns about biotechnology applications. Widespread negativism related to biotechnology has also been fostered by objections raised by some religious groups and environmentalist organizations. Animal rights activists protest biotechnology on the ground that many genetically modified animals suffer vulnerability to specific diseases as the result of such modifications. Religious groups oppose the use of biotechnology on the ground that experimenting with lives is like "playing God." These religious and ethical concerns are growing rapidly with the possibility that further advances in gene technology may lead to tampering of human genes in such ways as cloning and gene selection. These groups oppose the use of biotechnology on the bases of social, ethical and religious grounds and provide the public with bases to form an opinion without sufficient scientific knowledge to evaluate the benefits and risks objectively.

The fallacy is that if consumers are given the facts, they will come to the right conclusions. This fallacies takes a "consumers as Computational Machines" approach to

¹ Typically, science fiction that has dealt with genetic engineering, such as *Species*, *Jurassic Park*, *Gattaca*, and *DNA*, all emphasized the unpredictable and uncontrollable nature of genetic engineering and the disastrous effects of playing with the genes of living organisms.

understanding consumers. When forming attitudes and judgements about issues, such as biotechnology, basic human tendencies keep consumers from behaving exactly the way the computer program says they should operate. Some people weigh certain information as more important than other types of information. That is, a well-to-do vegetarian might believe cost savings are less important than how an animal is cared for. A second person concerned with world hunger might focus more on how biotechnology increases the world food supply and slows land commercialization. A third person might focus on comparing organic gardens of yesteryear to the unknown issues of tomorrow. What is happening is that consumers form their attitudes in different ways of how one combines the information they are objectively given.

Consumers differ significantly in terms of their prior knowledge about biotechnology, current biases toward biotechnology, and personality characteristics. These differences will lead to differences in information processing styles for biotechnology information. It is, therefore, important to develop customized strategies dissemination of biotechnology information tailored to the target audiences. Classification of consumers into several categories based upon multiple variables, such as prior knowledge, information processing style, and current biases toward biotechnology, would provide a sound basis for developing more effective strategies. Table 3 shows a tentative classification of consumers and corresponding strategies.

[Insert Table 4 Here]

Proponent Fallacy # 3. Biotechnology is an Industry Association Issue

Biotechnology is not an industry association issue. Biotechnology is a branding issue. It is providing a clear, systematic, vivid, focused message that is potentially important to consumers. In the branding biotechnology war, it is clear who has the upper hand. The powerful

visuals that are associated with names such as “FrankenFoods” and “Super Weeds” leave little wonder why the public is able to latch on to such bumper-sticker philosophies of skeptics and be moved.

It is unlikely that trade associations and scientific organizations, and the government can effectively brand biotechnology in a way that leaves it standing clear in a consumer’s mind. History indicates the majority of efforts by trade associations, scientific organizations and the government in this regard have not been as effective as hoped for or as claimed. Even the most notable examples (recall the “Got Milk” campaign), won awards, but reportedly contributed little to sales increases among nonusers.

If a company is to compete with the “spin” that opponents of biotechnology create, they need to realize that branding biotechnology is something that deserves some of their best marketing minds. It is not something to be outsourced and trusted to a more risk-averse counterpart.

In terms of trustworthiness, consumer organizations (Van Ravenswaay et al. 1992), environmental groups, and biology researchers are generally seen as the most reliable information sources, while the biotechnology industry was the least trusted source (Borre 1990a). Mistra et al. (1995) asked respondents to express the extent of their confidence in comments on food safety issues by different interest groups. The most trusted group consisted of university scientists, followed by independent laboratories and consumer groups. When looking at how to provide communication, it must be realized that the important issue is likely to be the least effective less unless supported by consumer groups.

Proponent Fallacy # 4. Good for Medicine Means Good for Food

Just because consumers accept biotechnology for medicines, this does not mean they will as readily do it for foods. Generally, consumers are more accepting of genetic engineering and biotechnology related to medicine than that related to food production. These differences may indicate that consumers weigh the perceived benefits and risks differently for genetic engineering depending upon the target of application. Prospect theory provides a possible theoretical framework to understand the differential perception and differential weighting of benefits and risks across application domains. This can be explained by the way the situation is framed – or perceived – by consumers. People show a risk-taking tendency when the outcome is framed as reduction of a loss (“I don’t want to be sick”), while becoming risk-averse when the outcome is framed as a gain (“I want to be healthy”). In general, biotechnology applications in the medical domain are framed as losses. For example, the benefit of a new medicine developed with biotechnology is generally framed as the improved health condition of an already ill patient. Thus, it is framed as a reduction of losses. The benefit of a food product produced with biotechnology, however, is framed as improved nutrition and quality for a product that already has satisfactory quality and nutrition from a consumer’s point of view, and, thus is framed as an increase in gains. Therefore, consumers are willing to take risks that will reduce a loss (“I’ll take medicine to not be sick”), but one loss willing to take risk for something that is classified as a benefit (“This food is more nutritious and more reasonable”).

If the differences in acceptance of biotechnology across application domains are due to differences in how the benefits and risks are framed as proposed by prospect theory, consumer acceptance of food related biotechnology may be improved by framing the benefits in terms of reduction of potential dietary hazards instead of framing them in terms of enhanced nutrition or quality (Wansink and Ray 1996).

Earlier, it was pointed out that confusion regarding criterion for weighing or evaluating benefits and risks involved in biotechnology may lead to deferral of decisions, or the total rejection of biotechnology. Therefore, it is critical to provide consumers with clear information for evaluating biotechnology and biotechnology products. The following is a listing of important consumer education points.

- Improving human health conditions through development of better medicines and better food production must take the top priority.
- The destructive effects of chemical pesticides and wastes are far more devastating to the ecological balance than those of genetically modified living organisms.
- Ethical concerns regarding the possible misuses of biotechnology should not interfere with the potentially beneficial use of biotechnology as a whole.
- Biotechnology products on the market have passed safety requirements and can be trusted.

Education Fallacies of Biotechnology Opponents

Opponent Fallacy # 1. People Want to Be Informed

The most successful daily newspapers in the world have less than a 40% penetration of their markets. Situation comedies generate more viewers than the average network news broadcast. Consumers vary in their desire to “be informed” about such issues. Some want to be actively involved in the determination of whether a product was suitable for them, while others have a people have greater willingness to trust outside agencies to make biotechnology decisions for them. Sheehy, Legault, and Ireland (1998) termed the first type of people “information-seekers” and the latter type of people “institutionalists.”

~~Most consumers appear to be institutionalists when it comes to safety issues, believing that decisions about the *safety* of biotechnology should be left to the experts (Optima Consultants, 1994). Rather than rely on their own incomplete knowledge, they prefer these decisions be made by experts with more complete and informed information (Sheehy, Legault, & Ireland, 1998). Although one might assume that this group consists of people with less formal education, Hadfield, Hoase, and Tribilecock (1998) found that even those with advanced educational backgrounds feel that they are ill-equipped or unwilling to spend time on the issue.~~

In contrast, when “information seeking” consumers want to learn of the risks and benefits of biotechnology and genetic engineering, they turn first to the media, to personal discussions, and then to informational brochures (Borre 1990a; Heijts & Midden 1995). Sheehy, Legault, and Ireland (1998) reported that another group of consumers acquired biotechnology information from magazines, government publications, consumer organizations, and research institutes.

Opponent Fallacy # 2. People Need to Be Informed

The United States has benefited from a strong food regulatory system for many years. This is unlike what is found in other countries. As a result, vigilance – as related to food issues – has been much more of a responsibility for people over in other countries. In the United States, most people believe the FDA. In fact, a recent poll showed that the most trusted government agency next to the Supreme Court was the FDA.

Most people (83%) trust the Food and Drug Administration. Double-thinking the decisions of the government is probably not something that is worth a tremendous amount of time nor effort. As a result, many consumers may not want to be informed, largely because they do not believe they need to be informed. In essence, they’ve outsourced the decision to the FDA and trust their judgement.

Opponent Fallacy # 3. Changing Consumer Attitudes Will Change Their Behavior

Based on both Tesser and Schaffer's (1990) model of attitude-behavior relationships, Heijs and Midden (1995) investigated the impact of attitudes on behavioral intentions across four examples of genetic engineering in food production. Intention to buy each of the products was used as a measure of positive intentions, while intention to protest against each of the products was a measure of negative intentions. Consumers' attitudes explained significant portions of the variance in the positive intention measure, but did not explain much of the variance in the negative intention measure (Tesser and Schaffer 1990; Heijs and Midden 1995). In essence, there is little relation between biotechnological attitudes and purchase. This may have to do with the ubiquitous nature of biotechnology products, and due to the weak impact between attitudes and behavior once there become notable differences in the cost or convenience of products.

Confusion often ensues because biotechnology can be complex, and difficult to understand. With this confusion, consumers are likely to defer their choices until proper evaluation criteria are developed and enough information is acquired, especially when the choice has significant consequences.

Opponent Fallacy # 4. Risks of the unknown are more important than benefits

History has repeatedly shown us that most principles, to most people, have a price. A principled stand against the radiation the emanates from microwaves becomes a non-issue when one person receives a microwave for a birthday present. An opponent of fur becomes a silent proponent after inheriting a coat with fur trim. The "white meat only" advocate secretly enjoys beef when the corresponding price of fish becomes prohibitively expensive. To many people, a

philosophical stance has its price. Under some circumstances it is measured in differences in costs, in others, differences in convenience. In still others, it fades as the audience for the cause fades or becomes weary of the issue.

In general, this risk/benefit trade-off is one of establishing how much cost or inconvenience a person is willing to go through to maintain a philosophical opinion. Consumers are willing to accept biotechnology products only if biotechnology products offer a significant improvements over the benefits of other products. These benefits can include decreases in price as well as increases in product quality (taste and naturalness), purity (reduced use of chemicals), and wholesomeness (Kuznesof and Ritson 1996). In these cases, perceived benefits had greater impact on consumer attitudes and acceptance than perceived risks (Hamstra 1995).

Sheehy, Legault, and Ireland (1998) confirmed this finding by demonstrating that specific benefits determined consumer acceptance. Genetically modified tomatoes that offered longer shelf life and improved taste may either seen as neutral or even as unfavorable. However, genetically engineered potatoes that reduced the need for environmentally harmful pesticides were seen as being significantly more beneficial than that which prolonged shelf life and improved taste.

The Next Steps: Consumer Analysis and Biotechnology Balance

The review of past studies on consumer behavior related to biotechnology provides several important insights into understanding the consumer acceptance process of biotechnology and its applications. The following section is devoted to the discussion of some implications for biotechnology and for consumer education that deserve special attention.

The Communication Hierarchy of Educating Consumers

The differences in prior knowledge about biotechnology and information processing styles among consumers suggest that communication strategies to disseminate biotechnology information and educate consumers should take a stepwise approach. In general, acceptance of biotechnology is a stepwise process. First consumers need to accept the processes of biotechnology, and only after that can they accept specific products themselves. Therefore, having information about and confidence in biotechnology is a necessary condition for acceptance of biotechnology products.

To address this, a hierarchical model of communication strategy is proposed. It will be necessary to disseminate general information such as what biotechnology is and what would be affected by it as the first step of the process. Consumers must have some basic level of knowledge about biotechnology in order to process more specific and detailed information. Next, information about biotechnology used by the specific industries can be understood. Once the technology or process itself is understood and accepted by consumers, then information about benefits and risks involved with the products can be more effectively conveyed. This way, consumers will be able to develop knowledge basis on which they can make educated decisions regarding specific biotechnology products. Figure 2 illustrates how the hierarchy of communication objectives can be structured in relation to the level of consumers' biotechnology knowledge.

[Insert Figure 2 Here]

Packaging and Labeling Must Accommodate Consumer Needs and Concerns

The environmental focus group participants in the Optima (1994) survey identified three functions of labeling biotechnology products: to protect consumer choice, to provide information on product ingredients for health reasons (e.g., allergies), and to encourage companies to provide

safer products by having disclosure requirements (Sheehy, Legault, & Ireland, 1998). While the main function of labels is the provision of information, the last function suggests that labeling may function as a cue for product safety. Some consumers may use such labeling to avoid biotechnology products. In contrast, consumers may perceive the explicit labeling as a sign of the manufacturers' confidence in product safety because they are willing to disclose such information although such disclosure is not required by law.

The results of the 1991 Euro-barometer survey, the largest survey to date on public attitudes towards biotechnology, reported an interesting finding related to labeling biotechnology products. The results indicated that the way that biotechnology products are labeled affected consumers' perceptions of and attitudes toward such products. The survey was conducted using a split ballot in which half of the respondents were questioned using the word "biotechnology" and the other half were questioned using the term "genetic engineering." Twice as many respondents in "genetic engineering" condition thought that the technology would make their lives worse than respondents would in the "biotechnology" condition.

We have learned in this chapter that consumers base opinion and purchase decisions upon an array of factors and cues. This information and stimuli can come in direct and indirect forms. From a marketing standpoint, it is critical to identify the target consumer and direct marketing efforts accordingly. The studies noted in this paper have provided some concrete information regarding consumer decision-making criteria and preferences. Clearly, consumers have pre-disposed attitudes towards particular terminology such as "genetic engineering." Regardless of the reasons behind these attitudes, it is important to accommodate the unease invoked by the terminology. Therefore, manufacturers should seek to avoid the use of potentially negative terms either through omission or the use of alternate terminology.

It has also been noted that consumers generally view product labeling as an important source of information when developing attitudes toward biotechnology products. Therefore, labeling and product packaging should reflect the positive aspects of the industry and methodology involved in production. When possible, consumer advocacy organizations and research institutions should be utilized as endorsers for the products or technology as they are viewed as most trustworthy.

In the meantime, it will be important to provide consumers a sense of control over their choices. The results of surveys and studies reviewed in this paper indicate that although consumers are ill equipped with knowledge, they still desire control in choosing what they eat. The use of labeling to provide biotechnology information regarding the production of the products can be important. Labeling of biotechnology products will not only serve an informational function but also serve as a safety signal and reduces concerns about being able to choose wanted products. Biotechnology communication strategies should provide consumers with criteria for evaluating biotechnology products. Consumers will be more comfortable and confident in accepting biotechnology as their confusion about what and how to choose diminishes.

~~Correctly Addressing Public Concerns is Critical~~

Controversy over safety and ethical issues involved in the use of biotechnology is a persistent problem and continue to haunt all who are involved even after consumer acceptance. Biotechnology is advancing into the future and some of the current safety issues may become non-issues. However, current public concerns are grounded on what has happened with past misuses of biotechnology. Concerns may partly be due to the fact that living organisms are adaptive and their change is not completely predictable and/or controllable.

Therefore, in the long run, the biotechnology industry and researchers as well as the government should try to safeguard potential hazards. First, objective measures of potential risks of hazards involved in biotechnology and biotechnology products must be developed. Without such measures, it will be impossible to convince consumers of biotechnology safety. Secondly, some legal and self-regulatory protection devices must be put in place by the government and industry. Lastly, and the most importantly, a code of ethics that guards against the potential misuse of biotechnology must be established and adopted by those who participate in the field of biotechnology. Different roles that should be played by different groups are suggested below.

Self-Regulation by Biotechnology Industry. Generally consumers perceive biotechnology information provided by the industry to be the least credible and are most distrustful of an industry regulated safety system. The biotechnology industry is the major provider of biotechnology products that consumers make choices about. Therefore, it is critical for the industry to earn consumers' trust. A self-regulatory effort by the industry may help gain consumer confidence. The biotechnology industry should strive to develop objective measures for risks and benefits of products and establish self-regulated safety measures of the processes used.

Disclosing information on the product labels is also important since it provides consumers control over their choices. The results of surveys and studies reviewed in this paper indicate that although consumers are ill equipped with knowledge, they still desire control in choosing what they eat. The use of product labeling to provide information regarding the biotechnology used to produce the products can be important. Labeling of biotechnology products will not only serve an informational function but also serve as a safety signal and reduces concerns about choice.

The Role of Government as the Safeguard. Despite some doubt regarding the efficiency of government, many focus groups and surveys indicate that consumers believe the government should play an important role in providing regulation and safety protection with respect to biotechnology. These provisions and assurances of safety by the government will contribute to eliminating some of the concerns consumers hold about biotechnology. The government should take the responsibility of setting the direction and pace of development to prevent questionable or premature application of biotechnology.

University and Research Institutions. Universities and other research institutions account for the majority of genetic engineering and biotechnology research and development. Therefore, they are well positioned to play a safety-assurance role as well as provide up to date information on biotechnology advances and applications. While industry sponsorship raises some concerns, the public views these institutions as the most credible and trustworthy source of biotechnology information. Therefore, a more active effort to establish and maintain integrity and impartiality of research by these institutions is important.

Placement Should Position Products as Comparable Alternatives

When contemplating product positioning in the market as a whole and at the individual store level, marketers should seek to align products with their non-biotech counterparts. This avoids the assignment of a stigma upon the products as being “fake” or “synthetic.” However, this is not as important when targeting biotechnology-savvy markets wherein differentiation techniques may even work as an advantage (Wansink 1994).

Additionally, efforts should be made to “tie-in” the products with brands and images that are highly regarded and give the impression of being natural. Through the use of brand equity

leveraging, innovative promotion, product pairing, etc., the products can achieve an air of familiarity, quality, and conventionality (Chandon, Wansink, and Laurant 2000).

Integrated, Yet Distinctive, Communication Channels Aid in Acceptance

Consumers acquire biotechnology information from various sources such as government publications, consumer organizations, research institutes, and the media. Because consumers perceive that there are conflicts among the various information sources and this perception can cause unnecessary confusion leading to rejection or deferral of acceptance of biotechnology products. An integrative and coordinated communication effort by the multiple information sources is essential in increasing consumer acceptance.

Consumers believe that *government* should play an important role in providing regulation and safety protection with respect to biotechnology. These provisions and assurances of safety by the government will contribute to eliminating some of the negative delusions consumers hold about biotechnology. *Universities and other research institutions* account for the majority of genetic engineering and biotechnology research and development. Therefore, they are well positioned to play a safety assurance role as well as provide up to date information on biotechnology advances and applications. While industry sponsorship raises some concerns, the public believes in impartiality of these institutions. Universities and research institutions are major providers of biotechnology advances. The *biotechnology industry* is the major provider of biotechnology products that consumers make choices. It is critical for the biotechnology industry to earn consumers' trust by implementing self-regulatory efforts. Finally, *media* has long been established as one of the main information sources for consumers, but less as a source of biotechnology information. The effect of mass media in disseminating biotechnology information has been inhibiting (i.e., distributing news about bio-hazards) rather than facilitating

(Wansink and Ray 1992). A variety of strategies to use mass media as the key information source, including advertising campaigns promoting biotechnology and public relations in forms of articles or programs that disseminate biotechnology information via various media formats, should be developed.

Provide Key Consumer Education

Summary

The accelerating growth of the biotechnology advances and its applications are interfering with consumer understanding. This incomplete understanding of biotechnology is leading to divided opinions. By providing a theoretical framework for understanding what factors affect consumers' acceptance of biotechnology, there are clear implications for labeling, promoting, publicizing, advertising, and pricing biotechnology products. A two-phase strategy for managing public opinion - focusing on short-term and long-term public opinion - is the key planning tool which provides structure for the more tactical efforts.

Conclusion

Despite the recent technological advances and growth of biotechnology applications in many areas, consumers' attitudes towards biotechnology and biotechnology products are

divided. This paper provides a theoretical framework for understanding what factors cause this divergence in consumers' acceptance of biotechnology by reviewing related research.

The findings of reviewed research indicates that consumers form their attitude toward biotechnology and biotechnology products through different types of processing. In some cases, consumers actively seek information and make trade-off between benefits and risks of biotechnology products. More often, consumers inherit attitudes or opinions from others because consumers generally have very little knowledge about biotechnology on which they can form their own attitudes. Factors that serve as peripheral cues to consumers' biotechnology attitudes and the factors that affect consumers' perception of benefits and risks of biotechnology were identified.

Although the reviewed research provide some insights into understanding consumer acceptance of biotechnology, further effort is required to provide a more definitive picture of this complex phenomenon. Biotechnology and biotechnology products are relatively new to most consumers and marketing researchers. Consequently, many of the studies presented in this paper are exploratory in nature. Therefore, further attempts to test the findings more rigorously are required. This review of the past studies provides some valuable guides for such future research.

Consider the source of a message. One study indicated that attitudes toward biotechnology changed depending on whether the source of information was attributed to consumer organizations, the government, or to government-consumer organization collaboration. Trust in the information source was found to have a significant impact on the attitude change by consumers who initially had negative attitude toward genetic engineering. Admission of a certain amount of risk uncertainty increased trust in the attributed source by consumers with prior negative attitudes (Frewer, Howard, and Shepherd 1998). Another study by Frewer et al. (forthcoming) also demonstrated a significant impact of the credibility of the information source on consumer attitudes.

Figure 1. Determinants of Consumer Attitude Toward Biotechnology

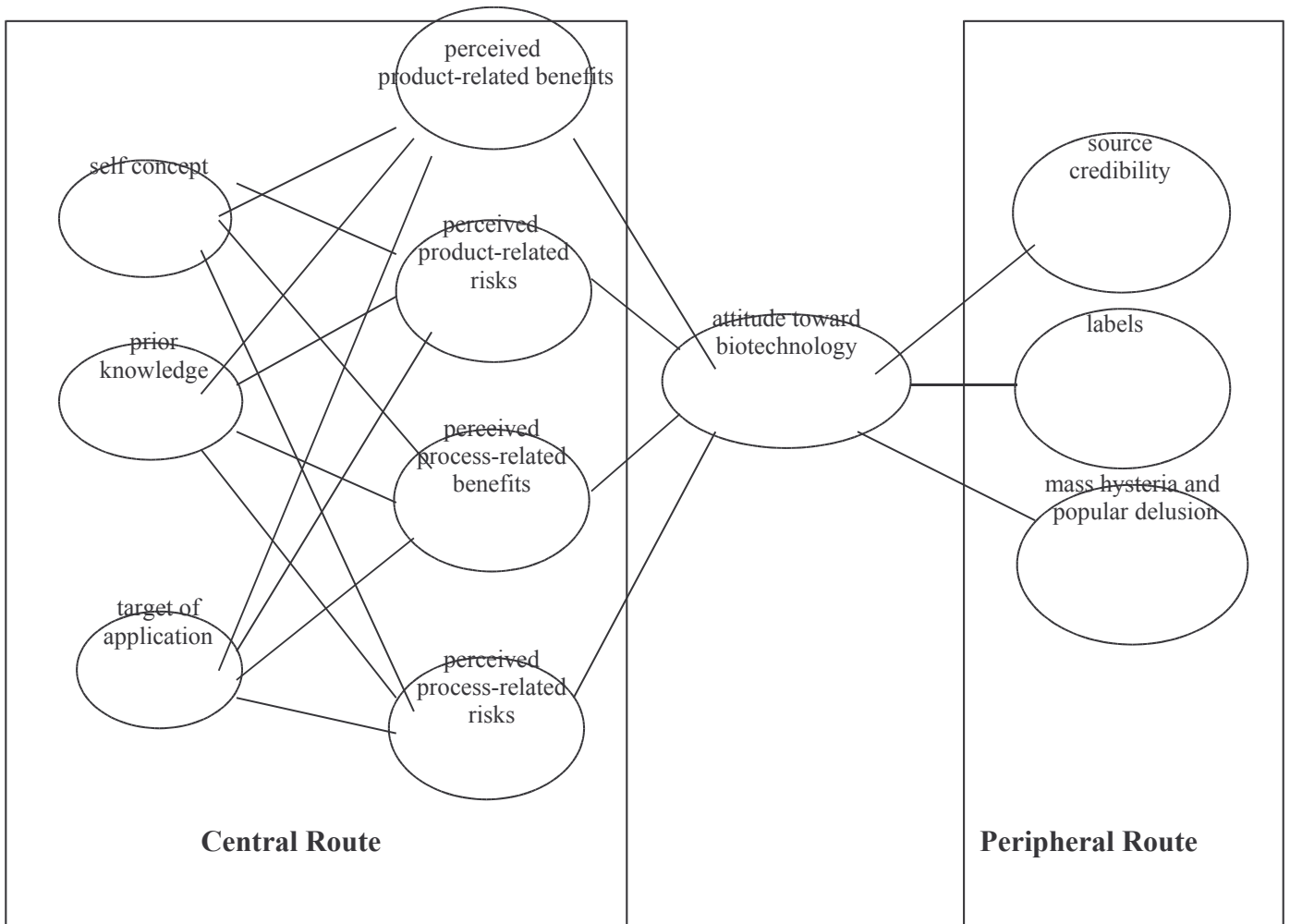


Figure 2. Layered Hierarchy of “Take-aways”

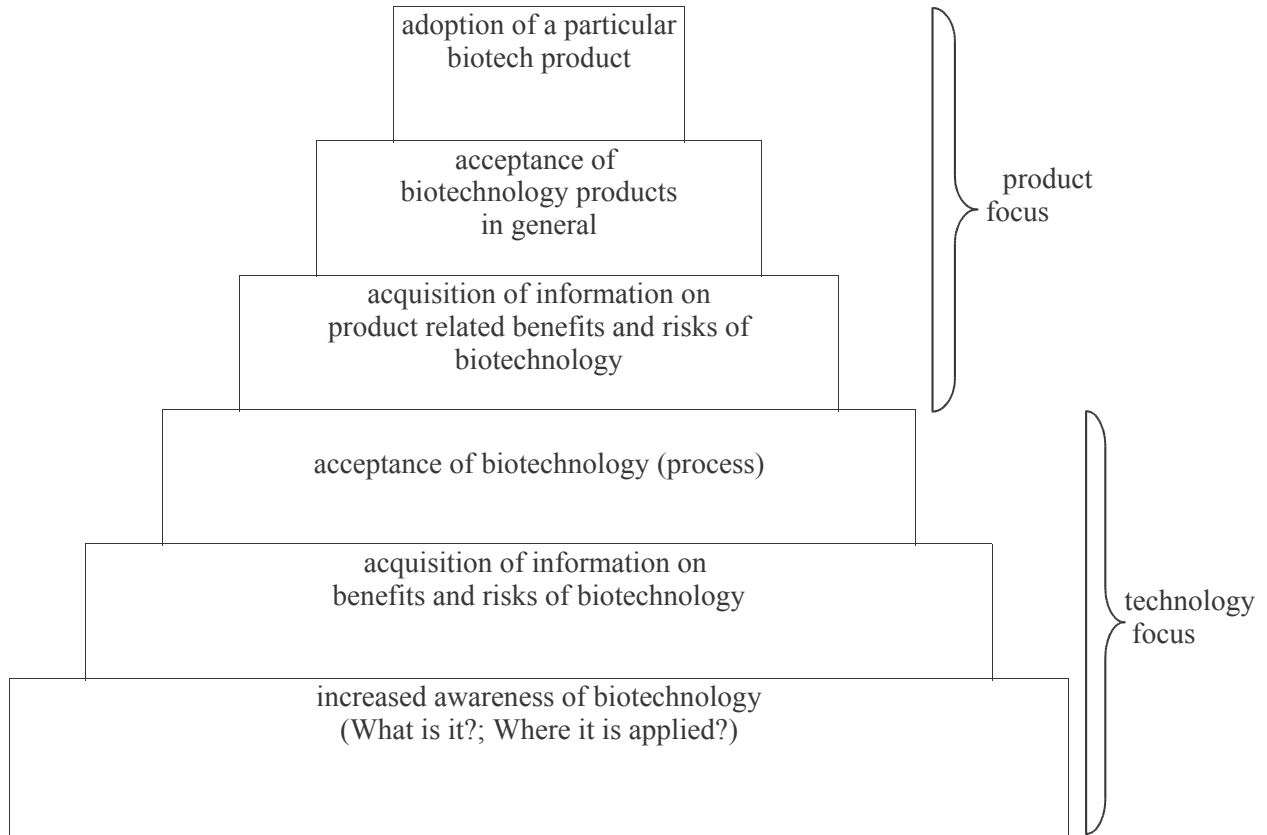


Table 1. What Do Consumers Think About Biotechnology?

– Some Quotes from a Recent Poll

<p>Pros: The Value of reducing pesticides and erosion while increasing yields far outweighs the risks that may involved</p>	<p>Cons: Genetically modified food is bad until and possibly even if proven otherwise</p>
<ul style="list-style-type: none"> - <i>After a while. I'm going to die from something. And, if I can get food cheaper in the meantime, I'm all for it.</i> - <i>The people who oppose genetic engineering are frankly, ignorant. They have allowed themselves to be swayed by emotional arguments against a technology, which has the potential to transform agriculture for the better. The whole subject renders me apoplectic. I would prefer a product that was genetically modified over one that wasn't.</i> - <i>I think it's wonderful. Man has been engineering his environment since day one, so what's the fuss all about? I'm all for using less resources to improve yield. A hundred years from now people will laugh at our superstitions regarding this new technology. Just as in the past, what's new and improved is often mistaken as harmful. Just enjoy the benefits.</i> 	<ul style="list-style-type: none"> - <i>Although the pro side has compelling arguments, I agree with critics. We just don't know enough yet.</i> - <i>They can do without pesticides and other things. The genetics scares the hell out of me. I am in the stage of my life that most of it is behind me, and hopefully the genetics will not affect me, but it sure will the generations below me.</i>

Source: "The Shoppers Report," The Consumer Research Network, Inc. (December, 1999)

Table 1. Revising Misguided Assumptions About Consumers and Biotechnology

	Misguided Assumptions	Revised Assumptions
Proponents of Biotechnology	The biotech issue will “blow over”	
	Once people have the facts, they will be bio-tech advocates	
	Science sells and Fear fails	
	Biotechnology is an industry issue	Biotechnology is a branding issue
Opponents of Biotechnology	People want to be informed	
	People need to be informed	
	Changing consumer attitudes will change their behavior	
	Risks are more important than benefits	

Biotech is an industry issue

Biotech is a branding issue

Table 2. Benefits and Risks of Biotechnology

Benefits of Biotechnology	Risks of Biotechnology
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1. Environmental Benefits

- A. Reduced Use of Chemical Pesticides
 - *improved ability of crops to defend itself against destructive insects*
 - *reduction and elimination of the need for chemical pesticides*
 - *more selective use of weed control and to use of environmentally gentler herbicide*
- A. Water and Soil Protection
 - *reduction of nutrients in farm runoff, increasing crops' fertilizer efficiency and conserving topsoil*
 - *low phytic acid corn and phytase feed enzymes reducing harmful phosphorus in farm animal waste*
 - *reduction of excess soil nutrients thorough more efficient use of fertilizer*
 - *reduction of greenhouse gas effects by keeping carbon sequestered in soil*

1. Health Care Benefits

- A. Development of Medicine Products
 - *production of human insulin needed by diabetics by inserting the gene coding for this hormone into bacteria*
 - *development of interferon and human growth hormone*
 - *genetically engineered vaccines such as those for hepatitis A, hepatitis B, meningitis and herpes simplex*
 - *identification of the cause of specific conditions like cystic fibrosis*
- A. "Edible Vaccines"
 - *fruits and vegetables that contain vaccines against deadly and debilitating diseases such as hepatitis, cholera and malaria*
 - *fruits and vegetables with higher levels of anti-oxidant vitamins to prevent cancer and heart disease*
 - *fruits and vegetables the contain vitamin A to prevent blindness*

1. Agriculture and Food Processing Benefits

- A. Protection Against Disease
 - *disease-protected varieties with the plant equivalent of a vaccine.*

1. Environmental Risks

- A. Threat to Ecological Balance
 - *the risks of releasing genetically modified organisms into the environment*
 - *unpredictability of their effect on the ecological balance of the environment*
- A. Reduced Biological Diversity
 - *creation of herds of 'multiple twins' of cattle, and single super-variety of crops that lead to extinction of traditional breeds or varieties*
 - *a single variety or breed is more vulnerable to devastation by rare pests or disease than a combination of different varieties*

1. Safety Risks

- A. Lack of Control
 - *genetically modified organisms are alive, therefore much less predictable, and more difficult to control*
- A. Difficulties in Measuring Safety
 - *concerns for the fact that the safety of biotech products cannot be absolutely assured*
 - *the safety of a biotech product is determined based upon the best information available at the time*
 - *lack of established objective and concrete measures of safety of biotechnology products*

1. Ethical Considerations

- A. Discomfort with "Playing God"
 - *concerns about playing with living organisms*
 - *vehement debates over "playing God"*

- *cloning and transfer of genes resistant to various animal diseases to increase the immunity*
- A. Increased Productivity
- *reduction of farming costs and increased yields on a per acre basis due to reduction of the need for chemical agents and labor to control weeds and insects*
 - *improvement in bacteria and yeast for the production of fermented dairy, meat, vegetable and cereal products*
 - *use of transgenic technology can accelerate desirable characteristics from one animal species to another in such areas as growth rate or reduction of fat, and produce proteins in the milk of sheep or cattle*
- A. Bio-diversity and Sustainability
- *biotechnologies that increase productivity on existing cultivated acreage reduces pressure to encroach further on wildlife habitat which is the greatest threat to bio-diversity*

1. Nutrition, and Food Quality Benefits

- A. Better Nutrition and Quality
- *soybean, corn and canola oils produced via biotechnology stand up better at higher temperatures, displacing the need for hydrogenated fats that contain unhealthful trans fatty acids and have lower levels of saturated fat*
 - *delayed-ripening traits allow fruits and vegetables to vine-ripen for better flavor and to remain fresh longer for better shipping and storage and increases availability of nutritious fruits and vegetables and improves their taste and quality*

B. Concerns for Health and Welfare of Animals ³⁰

- concerns about the health or welfare of experimental and farm animals produced using rDNA technology
- past incidents where experimental pigs carrying the gene for human growth hormone suffered from crippling arthritis
- criticisms of the use of BST on the grounds that increase in mastitis in cows who have been administered BST

C. Religious Taboo

- Polkinghorne Committee's report (1992) concerns about ethical issues related to the transfer of genes from animals whose flesh is forbidden for use as food by certain religious groups to animals that they normally eat.
- Is the sheep that has transferred gene from a pig a cheep or a pig?

Source: Biotechnology Industry Organization (1999)

Table 3. Profiles of Consumers and Communication Strategies

Prior Knowledge	Current Biases	Processing Style	Communication Strategies
High	Favors	Mixed	<ul style="list-style-type: none"> - least need for intensive persuasion - keep them abreast of up-to-date information - distribute biotechnology information leaflets or news letters
	Opposes	Central	<ul style="list-style-type: none"> - use two sided message: benefits and risks - provide statistics to evidence safety of biotechnology - use of labels
	Mixed	Central	<ul style="list-style-type: none"> - use of heavy point-of-purchase promotion - provide information through labeling - provide clear evaluation criteria
	Don't Care	Peripheral	<ul style="list-style-type: none"> - keep it a non-issue to them - minimize negative publicity
Low	Favors	Peripheral	<ul style="list-style-type: none"> - need to reinforce the attitude constantly - use of expert endorser
	Opposes	Peripheral	<ul style="list-style-type: none"> - use highly credible endorser - focus on eliminating delusions - use one-sided message emphasizing benefits
	Mixed	Mixed	<ul style="list-style-type: none"> - use of heavy point-of-purchase promotion - use highly credible sources
	No Idea	Peripheral	<ul style="list-style-type: none"> - focus educating basic general information - mass advertisement to increase general awareness - provide rules to evaluate

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