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Why Mandatory Biotech Food Labeling is Unnecessary

by Gregory Conko

October 2002

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Acknowledgments

The author would like to thank Jonathan Adler, J.D.; Sam Kazman, J.D.; Terri Lomax, Ph.D.; Wayne Parrott, Ph.D.; and Jim Peterson, Ph.D. for their helpful comments on sections of this paper.

The Oregon Better Government Competition

This report is a product of Cascade's Oregon *Better Government Competition*. From its inception in 1994, the *Competition* has focused on ways to improve service quality and reduce the cost of government in Oregon.

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Executive Summary

An estimated 60 to 70 percent of the foods on grocery store shelves contain ingredients developed with advanced biotechnology—a variety of techniques that are alternatively known as bioengineering, genetic engineering, and recombinant DNA engineering. Virtually every person in the United States has consumed such foods. However, many consumers don't realize this, because labels on these products generally do not explain that biotechnology was used in their production.

Some consumers are becoming increasingly interested in learning about the “genetic status” of the foods they eat. With that in mind, Oregon citizens will vote in this year's election on a ballot initiative (Measure 27), which purports to give consumers that information. Ballot Measure 27 would require special labeling on any food items produced, sold, or distributed in the state, if they contain or are derived from “genetically engineered” material. That labeling requirement would include bioengineered whole foods such as fruits and vegetables, processed foods with biotech ingredients such as corn sweeteners and soy oils, milk or meat from livestock fed with bioengineered grains, even pet foods. Every farmer, food and beverage producer, restaurant, bakery, farm stand, grocery store, and convenience store in the state would have to comply.

Although the mandatory labeling of biotech products appears to be popular, it is a flawed idea. Food labels are a very important source of consumer information, so what goes on them is strictly regulated. Information on labels must be not just truthful, but also not misleading. Any mandatory label statement can make food products appear to be different in some important way from their counterparts without those statements.

Numerous scientific bodies, including the American Medical Association, the National Academy of Sciences, the World Health Organization, and the Institute of Food Technologists, have found that biotechnology does not make the end products inherently different in any meaningful sense. In those few cases where bioengineered foods have been made different from their conventional counterparts in a way that relates to consumer health, existing government policy already requires them to be labeled to reflect those changes.

The above scientific bodies and many others have studied biotechnology and bioengineering and have found the techniques to be as safe as or safer than conventional breeding methods. Despite these assurances of safety, every single bioengineered product on the market has nevertheless undergone more testing and government scrutiny than practically any other food product in history.

That is one reason why federal courts have ruled other biotech food labeling mandates, similar to Measure 27, unconstitutional. Several court decisions have agreed with existing government policy, finding that requiring all bioengineered foods to be labeled could mislead consumers into believing that there was an important difference between bioengineered and conventional foods, even though there is not. Courts have also ruled that mandatory labeling of bioengineered foods would be a violation of the First Amendment's free speech protections, because neither private citizens nor businesses can be compelled to say or print things unless there is a legitimate reason for doing so. For the same reasons, Measure 27 is also likely to be found unconstitutional.

Importantly, Oregon Ballot Measure 27 cannot even promise to fulfill the basic objective

of identifying “genetically engineered” foods so consumers can exercise choice. The measure actually defines many conventional breeding methods as “genetic engineering,” which means many non-genetically engineered farm products would have to be labeled as if they were. In the end, a “genetically engineered” label could be required for the vast majority of foods grown or sold in the state of Oregon, and consumers would not be able to rely on the mandated label statements to make accurate purchasing decisions.

Labeling all bioengineered foods would also be quite costly to producers and consumers. Complying with the overly broad requirements of Measure 27 would be expected to raise retail prices of food products by at least 9 to 10 percent for nearly every food sold in Oregon grocery stores, restaurants, and elsewhere. In addition, according to the Oregon Department of Administrative Services, the cost to enforce compliance—paid by Oregon taxpayers—would be more than \$11.2 million per year, with additional start-up costs of over \$6.3 million during the first year.

Though a labeling requirement cannot deliver real consumer choice, alternative avenues are already available to consumers. Food producers that purposefully do not use bioengineered ingredients—such as organic farmers, packagers, and retailers—are voluntarily providing information on product labels that let consumers avoid biotech-derived foods. Consequently, ordinary market forces have shown that a labeling mandate is not necessary to provide consumers with a real consumer choice—it is already available. If Oregon voters enact Ballot Measure 27 into law, it will serve to undermine, not enhance, real consumer choice.

Introduction

Ask a group of average citizens what they know about biotechnology, and most will tell you they know very little.¹ But today, an estimated 60 to 70 percent of the foods on grocery store shelves contain ingredients derived from advanced biotechnology methods—a variety of techniques that are alternatively known as bioengineering, genetic engineering, and recombinant DNA engineering. Virtually every person in the United States has consumed such foods.²

Although a majority of Americans support the use of biotechnology in food production,³ many are troubled by the fact that biotech-derived foods in the United States are typically not labeled. The relative novelty of these technologies has created a concern among some consumers that “bioengineered” foods may be less safe than conventionally-produced foods, or that their production may harm environmental quality. Some have called for product bans, others for a moratorium on biotechnology research, still others for much greater regulation than currently exists. At the very least, critics argue, shouldn’t consumers have the right to know how their foods have been changed?

Many consumers already base their food purchases on individual preferences such as nutrition and fat content, or aesthetic preferences such as taste, texture, or even color. Some, such as consumers of kosher, halal, and organic products, base purchases on the methods and technologies used in food production. And information identifying the production processes involved in the development of those foods can be found on food labels. Why then, the theory goes, shouldn’t bioengineered products be labeled too?⁴

A movement, led primarily by opponents of the technology, has arisen within the United States and abroad to lobby for laws mandating that bioengineered foods and ingredients bear labels identifying the process used in their production. And many average consumers are beginning to agree, telling pollsters that they too would like to know about the “genetic status” of their foods.

In this year’s election, Oregon residents will have an opportunity to vote on one proposal that is purported to give consumers exactly that information. A ballot initiative (Measure 27), promoted by the political action committee Oregon Citizens for Safe Foods, would require a notice on the labels of food containing or derived from “genetically engineered material.” Any bioengineered whole foods, beverages, processed foods, animal feeds, food additives, or other ingredients, sold or distributed in the state of Oregon, or produced in Oregon and shipped elsewhere, would be subject to the labeling requirement.

Thus, products as diverse as chewing gum and chocolate produced with biotech ingredients, milk or meat from livestock fed with bioengineered grains, and even pet food, would be required to carry a label that identifies them as “genetically engineered.” Every farmer, food and beverage producer, restaurant, bakery, deli, farm stand, bake sale, farmers market, grocery store, and convenience store in the state would be forced to comply.

The call for labeling of bioengineered products often seems persuasive. Despite seemingly compelling arguments put forth by supporters, mandatory labeling of biotech products is a flawed idea. After all, dozens of scientific bodies have studied biotechnology and bioengineering and have found the techniques to be as safe as or safer than conventional breeding methods.⁵ Bioengineered

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Measure 27 could require a label for practically every food grown or sold in the state of Oregon. In the end, consumers would not be able to rely on the mandated label statements to make accurate purchasing decisions.

products have nevertheless undergone more testing and government scrutiny than practically any other food products in history. Additionally, mandatory labeling of similar products has already been ruled unconstitutional by federal courts. Labeling would needlessly mislead consumers and would unfairly add to the expense of many foods.

Perhaps most importantly, a labeling mandate is not genuinely needed to provide consumers with a real choice between bioengineered and non-bioengineered foods. There already are alternative avenues available to consumers who wish to avoid biotechnology-derived food products. Furthermore, in the case of Oregon Ballot Measure 27, the call for a labeling mandate cannot even promise to fulfill this basic objective. The measure actually defines many non-bioengineering processes as “genetic engineering,” which means that many conventional farm products would get caught in a complicated and expensive regulatory morass that is totally unwarranted. A label could be required for practically every food grown or sold in the state of Oregon. In the end, consumers would not be able to rely on the mandated label statements to make accurate purchasing decisions. If Ballot Measure 27 is enacted into law by Oregon voters, it will undermine, not enhance, real consumer choice.

What is Biotechnology and How Do We Know it's Safe?

Biotechnology is a term that has been used for nearly 100 hundred years to describe the use of living organisms to produce consumer or industrial products. More recently, it has come to represent in the vernacular only the techniques of bioengineering or recombinant DNA methodology. The first food product made with this “new” biotechnology became

available in 1990 with the introduction of a bioengineered enzyme used to produce cheese.⁶ This product, called chymosin, is a substitute for the “natural” clotting agent rennet, an enzyme scraped from the stomach lining of calves. Because chymosin is produced in a laboratory environment, it is generally considered a safer product and of higher quality than natural rennet. The next biotech food product to hit the market was an engineered growth hormone for cows, used to boost milk production. The bovine growth hormone somatotropin is naturally produced by a cow’s pituitary gland. Using bioengineering—i.e. recombinant DNA techniques—scientists were able to recreate this protein in a laboratory. The bioengineered version, recombinant bovine somatotropin (rbST), is chemically indistinguishable from the cow’s own natural hormone, and it was approved by the Food and Drug Administration in 1993.⁷ It should be noted, though, that cheeses produced with chymosin and milk from cows treated with rbST should not themselves be considered bioengineered. In neither case is the bioengineered material that was used in their production actually present in the final food product.

The first commercial bioengineered plant, the Calgene corporation’s FlavrSavr slow-ripening tomato, was introduced in 1994.⁸ Since that time, some 70 new bioengineered plant varieties have been approved by the U.S. Department of Agriculture for cultivation in the United States and by the Food and Drug Administration for use in food—though fewer than half of those are grown commercially.⁹ Approved varieties include corn, cotton, papaya, potato, tomato, soybean, squash, and several others, expressing a range of improved traits, such as heightened resistance to certain insects and diseases, tolerance to herbicides, and longer shelf life. Although some varieties have not been readily adopted by

farmers, 26 percent of all corn, 68 percent of all soybeans, and 69 percent of all upland cotton grown in the United States last year were bioengineered varieties.¹⁰ Around the world, bioengineered crops are grown commercially on over 130 million acres by some 5.5 million farmers, in countries ranging from Argentina, Australia, Brazil, Canada, China, Mexico, South Africa, Spain, and the United States.¹¹

Opponents of biotechnology have long claimed that bioengineered plants are unnatural and dangerous. Criticisms range from general charges of random, unintended effects that could make the plants unsafe, to more specific allegations that the techniques could introduce new toxins or allergens in the food supply. Are these legitimate concerns, or are they just scares dreamt up by opponents of the technology? Critics often point to data in a handful of scientific studies that seem to validate their concerns. Too often, though, the critics distort scientific findings by exaggerating the data that suit their purposes, much like a funhouse mirror distorts the true reflection of real-world objects. To understand whether or not bioengineering poses genuine risks, one must consider it in the context of other, more conventional methods that are used to modify plants and animals.

Bioengineering—called recombinant DNA engineering by scientists—is a set of techniques used to identify specific genes in the DNA of certain organisms that may be especially useful, isolate those genes, and transfer them into different organisms. These techniques can also be used to add additional copies of genes that are already in an organism’s DNA, or to remove from organisms certain genes that may be harmful or otherwise detrimental. For example, a gene for insect resistance can be taken from a

harmless bacterium and put into a crop, making it resistant too. A gene in tomatoes that makes them get softer as they ripen can be “turned off,” extending their shelf life. Or a single gene from a plant virus can be put into a crop plant, making it immune to infection—serving the same purpose as a human vaccine.¹² Other modifications (most of which are not yet available commercially) have improved the nutritional value of certain foods—adding vitamins or minerals, for example—or have improved the ability of crop plants to tolerate extremes of heat or cold.¹³ The possibilities are virtually endless.

The function of most genes is to provide the cellular blueprint for making proteins and other substances, such as carbohydrates and fats. Because some new proteins and other “gene products” that theoretically could be introduced into plants or animals could be harmful, it has been easy for activists to convince the uninformed that biotechnology poses a genuine health threat.

It is important to note, however, that moving genes into and out of plant and animal DNA is also the exact purpose of more “conventional” breeding methods, which include much more than just normal sexual reproduction. Sometimes, unexpected problems can arise when breeders try to manipulate plant or animal traits, but this is true of both bioengineering and any of the techniques that are identified as conventional, or “classical,” breeding. Consequently, every one of the risks hypothesized about biotechnology also exists for conventional techniques. Both pose a limited risk of introducing potentially harmful proteins and other substances into the food supply, some of which could be allergens or toxins.

However, this is where the similarity ends. With conventional methods, breeders usually

The value of bioengineering is that it lets plant breeders select specific individual genes, identify exactly what they do, and test the safety of the genes, proteins, and other substances they produce, both before and after they are transferred into the new organism.

There is no evidence that any of the bioengineered food products that have ever been put on the market pose any genuine risk to human or animal health.

are introducing many new genes and proteins all at once, or changing existing ones, with only limited knowledge about exactly what the function of each gene is, or even which ones are being altered. Thus, plant breeders generally have little knowledge about which genes combine to create new crop varieties, which proteins and other gene products are expressed and at what levels, or which traits have been introduced or changed. Yet these conventional breeding techniques are routinely used to introduce entirely new proteins and other substances into food crops, often from wild species never before part of the food supply.¹⁴

Dozens of new plant varieties produced through imprecise conventional methods of genetic improvement enter the marketplace each year without any scientific review or special labeling. Many are from “wide cross” hybridizations in which large, sometimes huge, numbers of genes are moved from one species or one genus to another to create a plant variety that does not and cannot exist in nature.¹⁵ Still others are created by using radiation or chemicals to induce random genetic mutations, a small fraction of which turn out to be beneficial.¹⁶ In these latter cases, breeders have no real knowledge of the exact nature of the genetic mutation or mutations that produced the useful trait, or of what other mutations might have occurred in the plant. But more than 2,250 mutation-bred varieties of corn, wheat, rice, and dozens of other crop varieties have been commercialized over the last half century, and thousands more have been bred from these first generation plants. They and/or their offspring are grown in more than 50 countries around the world, including the United States.¹⁷

Wheat, the biggest Oregon farm crop, has been among the most commonly manipu-

lated species. Wheat, which itself is a combination of three different grass species from two different genera, has been the subject of dozens of “wide crosses” with a variety of other grass species—some domesticated, most wild.¹⁸ According to the International Atomic Energy Agency, nearly 200 different varieties of bread wheat have been produced with mutation breeding, as well as some 25 varieties of durum pasta wheat.¹⁹ These are just some of the methods categorized as “conventional” plant breeding that are not opposed by critics of biotechnology.

The value of bioengineering is that it lets plant breeders select specific individual genes, identify exactly what they do, and test the safety of the genes, proteins, and other substances they produce, both before and after they are transferred into the new organism. It is exactly this precision and specificity that makes scientific organizations such as the American Medical Association,²⁰ the World Health Organization,²¹ the Institute of Food Technologists,²² and the National Academy of Sciences²³ believe that biotech methods can actually produce foods that are safer than conventional ones. In a 1989 report the U.S. National Research Council, a division of the National Academy of Sciences, found that:

“Recombinant DNA [bioengineering] methodology makes it possible to introduce pieces of DNA, consisting of either single or multiple genes, that can be defined in function and even in nucleotide sequence. With classical techniques of gene transfer, a variable number of genes can be transferred, the number depending on the mechanism of transfer; but predicting the precise number or the traits that have been transferred is difficult, and we cannot always predict the [character-

istics] that will result. With organisms modified by molecular methods, we are in a better, if not perfect, position to predict the [characteristics].”²⁴

Ultimately the report concluded that bioengineering poses no new or unique risks compared with conventional breeding methods. Thus, regulation of modified plants, animals, and other organisms, should focus on the traits of each individual product, not on how the products were created. These conclusions have been repeated time and again by the National Academy of Sciences and its National Research Council, including in more recent reports published in 2000 and 2002, and from dozens of other scientific organizations.²⁵

It is important to note that the risk for any type of breeding is generally quite small, and that, over time, plant breeders, biologists, and farmers have identified methods to eliminate potentially dangerous plants before they ever make it to market. Compared with the mass genetic alterations that result from using wide-cross hybridization or mutation breeding, however, the direct introduction of one or a few genes into crop plants with bioengineering results in much more subtle and far less disruptive changes. This makes it much easier to ensure the safety of bioengineered foods than conventional foods. Indeed, over the last decade, thousands of new food products that include ingredients created with the aid of biotechnology have been developed, tested, and then marketed without incident. A number of conventional crop plants are known to have caused human illnesses due to unanticipated chemical changes resulting from traditional breeding methods—including several varieties of potato and celery.²⁶ However, there is no evidence that any of the bioengineered food products that have ever been put on the market pose any genuine risk to human or animal health.²⁷

Consumer Opinion and the FDA’s Current Labeling Policy

Labeling advocates argue that a substantial portion of the American public want bioengineered foods to be labeled. To support their claim advocates point to public opinion surveys conducted over the past few years in which majorities of respondents agreed that labeling would be a good idea.²⁸ However, those same surveys also show that large majorities of respondents know little or nothing about biotechnology and genetic engineering techniques,²⁹ which calls into question the validity of activist conclusions about the nature of public opinion. Asking people to evaluate the merits of a public policy option with little or no background knowledge can give a false or misleading picture of the public’s true attitudes. In a 2001 survey, 70 percent of respondents said they favored labeling of bioengineered foods. But in that same survey, 40 percent of respondents agreed that foods “made from cross-bred corn” should be labeled.³⁰ But practically all the corn grown in the United States is from cross-bred, or hybrid, varieties. Labeling in this case would therefore be totally extraneous, convey no useful information, and make absolutely no sense. Indeed, how many of the respondents who say they support biotechnology labeling even know that the Food and Drug Administration already has a labeling policy for bioengineered foods?

The FDA’s policy on biotech food labeling is described in a 1992 statement published in the *Federal Register*.³¹ In detailing how the agency would regulate foods developed from new plant varieties, the FDA explained that its policy would require specific labeling if, and only if, the composition of those foods differs “significantly” from their conventional counterparts. Such differences would include, among other things, the introduction

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Kosher, halal, and organic production certification are prime examples of how the interplay of consumer demand and market competition is capable of conveying relevant information about food production processes without government mandates.

of an allergen that is not present in the new plant's conventional counterpart, the reduction or increase in nutrients from what would be expected of the conventional counterpart, or even a change in the expected storage or preparation characteristics of the food. The FDA has held the same view of animal-derived biotech foods, such as milk from cows treated with a bioengineered growth hormone.³² To date the only biotech-derived food products that would have to bear such a label include cooking oils from soybeans and canola that have been bioengineered specifically to alter their fatty acid composition. The labels on these products need not specify that they are derived from bioengineered plants, but they must specify the fat content changes that have been made.

This science-based labeling requirement is applied to all foods, whether they were developed through conventional breeding methods or the more advanced genetic techniques.³³ Thus, the standard is consistent with the general scientific consensus that plants developed with new biotechnologies are not inherently more risky than those developed with conventional techniques, and that regulation and labeling ought to be based on the specific characteristics of the products that could make them more or less safe, not how they were created. Consequently, FDA's biotech labeling policy has been endorsed by such scientific organizations as the American Medical Association³⁴ and the Institute of Food Technologists.³⁵

Contrary to the claims of activists, most consumers seem to find the FDA's current policy satisfactory once they learn about it. In a series of polls commissioned by the International Food Information Council (IFIC) and conducted by a professional market research firm, respondents were read a summary of the FDA's current policy on labeling and

asked if they supported or opposed it. In each survey a majority of respondents agreed with the FDA's labeling policy.³⁶ Because respondents were given a summary understanding of the agency's current policy before they were asked to comment on it, the results of the IFIC surveys should be given more credence than surveys of otherwise uninformed members of the public. Drawing a clear conclusion that the public genuinely supports mandatory labeling is unwarranted, given the limited level of background knowledge upon which other attitudinal research is based.

Voluntary Labeling and the Market for Information

Although producers are not required to label biotech-derived foods, they are permitted to label bioengineered products voluntarily, and some have test-marketed affirmatively labeled biotech products. The Calgene company's FlavrSavr slow ripening tomato was voluntarily labeled and was initially well-received by consumers, many of whom were willing to pay a premium for the improved flavor promised on the labels.³⁷ Affirmatively-labeled cans of processed paste from the Zeneca company's bioengineered tomato variety sold well in British grocery stores until retailers were hounded by anti-technology activists to remove all bioengineered foods from store shelves.³⁸ Still, most food sellers have not labeled their biotech-derived products, and have taken this route for a variety of reasons.

First, it's worth noting that the biotechnology companies typically are an entirely different part of the production chain from food processors, packagers, and retailers. Biotechnology firms generally sell bioengineered products, such as plant seeds, directly to farmers, but not to end-use consumers. And biotech firms actually *do* label their products as such, because the added traits make a

meaningful difference to farmers. However, whereas most biotech products provide overt benefits for farmers, they provide only indirect benefits to consumers, in the form of lower environmental impact and modest cost reductions—benefits about which most consumers are unaware. To consumers, there is no meaningful, or even discernable, difference between conventional corn or soybeans and most bioengineered varieties.

Thus, given the lack of obvious consumer benefits, and the presence of a politically-charged atmosphere surrounding the production of biotech-derived foods, food producers have a legitimate fear that some consumers might reject their products if they were labeled as “bioengineered.” The food industry is characterized by extremely low profit margins. So, if even a small number of consumers (as few as five or ten percent) rejected biotech products, food sellers could lose important market share, which would be highly damaging to any product line. Thus, when confronting threats of boycotts by anti-biotech activists, one can understand why major food processors and retailers would be reluctant to put their brand reputations at risk.

More importantly, adding a label would defeat the purpose of most of the biotech crops now on the market. Producers of the most common biotech crop varieties have altered them in ways that aid farmers in production—by making them resistant to insect pests, plant diseases, or herbicides, for example—but without altering the end use qualities relied upon by food processors and consumers. This aids farmers by enabling the harvested bioengineered crop to be commingled into the normal commodity stream for each variety. All yellow corn, all canola, and all soybeans can be treated the same by grain elevators, shippers, millers, processors,

and consumers, whether the harvested crop comes from bioengineered plants or conventional ones. This source of efficiency adds to the attractiveness that biotech products have for farmers. In contrast, labeling the foods made from bioengineered varieties would require that they be segregated from conventional varieties all the way through the supply chain—necessitating an entirely separate and superfluous commodity stream for every biotech crop, but serving no apparent purpose.³⁹

The future of biotechnology is not just in commodity crops, however. A few crop varieties engineered to provide added consumer benefits are now being grown, though in limited quantities. These include soybeans that produce cooking oils with lower levels of unhealthy saturated fats than occur naturally.⁴⁰ As the Flavr-Savr tomato example suggests, once more bioengineered food products begin to provide clear and direct benefits to consumers—and benefits for which consumers will be willing to pay a premium—food processors are likely to label them voluntarily so the price premium can be captured.⁴¹

Competition and Label Information

Although the return of affirmatively-labeled biotech products is still some years away, today’s consumers still do not need to call for mandatory labeling of bioengineered foods to make an informed choice. Real world examples show that markets are fully capable of supplying information about the methods in which foods and other products are produced if consumers truly demand it.⁴² Kosher, halal, and organic production certification are prime examples of how the interplay of consumer demand and market competition is capable of conveying relevant

Organic food production and certification provides an especially good example of how the market can meet consumer demand for process labeling. Until very recently, a totally market-driven process fulfilled the consumer demand for products produced in this way, with some 33 private organic certifying organizations operating in the United States alone in 1999.

Consumers wishing to purchase non-biotech foods need only look for certified organic products in order to exercise choice.

information about food production processes without government mandates.

For religious purposes, many Jewish people purchase foods that have been processed according to kashrut, or kosher, dietary rules—an often complex set of requirements, spanning the entire process of raising, harvesting, selecting, preparing, and eating foods. Due to the similarity in Jewish and Muslim dietary restrictions, many Muslims purchase kosher foods to satisfy the requirements of Islamic halal rules. Increasingly, many other consumers have begun purchasing kosher foods for non-religious reasons, including a perceived sanitary or nutritional improvement over other foods. To ensure that these foods are in fact processed according to kashrut rules, a large number of private kosher certification organizations have been formed. Because the kashrut has been interpreted in a variety of slightly different ways by different readers, there is a demand by purchasers of kosher products for foods that meet varying degrees of kashrut “strictness.” Consequently, most kosher certifiers have slightly different standards from the others, and consumers of kosher products are thus able to seek out only foods approved by specific certifying organizations that meet their needs.⁴³ Here the market has provided not just production process information demanded by consumers, but very specific production process information. Furthermore, the existence of competing certification organizations provides a level of consumer choice that would be impossible under a government-imposed, one-size-fits-all labeling scheme.

Organic food production and certification provides an especially good example of how the market can meet consumer demand for process labeling. Organic certification conveys to consumers that the foods in question

were produced in accordance with a “holistic view of food production,” and that they were not produced using certain technologies, such as synthetic chemical pesticides, soluble mineral fertilizers, and biotechnology. Some consumers believe organically produced foods are in some way healthier than conventionally produced foods. Until very recently, a totally market-driven process fulfilled the consumer demand for products produced in this way, with some 33 private organic certifying organizations operating in the United States alone in 1999.⁴⁴

Under a 1990 law passed by Congress, the U.S. Department of Agriculture was required to create a single national standard for what processes and practices would be considered “organic.”⁴⁵ After more than a decade of trying to create a uniform definition for this concept, the USDA issued its final rule in December 2000.⁴⁶ Now, instead of various certification agencies and organic producers providing a choice among levels of organic strictness, there is just one national standard. Nevertheless, it is important to note that the government’s role in organic food labeling is limited to defining the terms, concepts, and practices that may be used in organic production, to prevent false advertising and consumer confusion. Although farmers, food processors, and retailers may not label their products as organic without an official organic certification, they are free to choose whether or not they will meet those USDA standards. No law or regulation requires growers to produce organic foods, nor does any rule require that organic foods be labeled. Thus, organic certification and labeling should still be viewed as market-driven responses to consumer demand.

Interestingly, to the extent that a real consumer demand for information about the genetic status of food products currently ex-

ists, it comes primarily from consumers wishing to purchase foods that are not genetically engineered. Inasmuch as these consumers want information so they may purchase non-biotech products, perhaps it is those products that should be labeled. Fortunately, no government mandate is needed. Under both the older, private certification systems and the new U.S. Department of Agriculture standards, food products labeled as organic cannot contain bioengineered ingredients.⁴⁷ Consequently, consumers wishing to purchase non-biotech foods need only look for certified organic products in order to exercise choice.

Furthermore, voluntary labeling and certification specific to non-bioengineered foods is already being pursued.⁴⁸ Ice cream maker Ben & Jerry's voluntarily labels its products as produced with milk from cows not given rbST.⁴⁹ In 1999, one of the largest organic-certifying organizations established a private "genetic" certification company to meet a "growing demand by consumers, governments and the food industry for rigorous and ethical third-party certification of food and fiber production" that excludes biotechnology.⁵⁰ Members of the organic and "natural" foods industry in the United Kingdom formed an organization called Genetic Food Alert, to register food producers in that country that do not use bioengineered ingredients.⁵¹ Other activist groups, such as Greenpeace, have played the role of certifier, by posting notices on its website and issuing press releases when certain food companies announce that they will not use bioengineered supplies.⁵²

Each of these examples demonstrates that when consumers demand certain types of information the market has generally found a way of supplying them—even in cases where that demand is not extensive. More

recently, to aid market processes, the FDA proposed a set of guidelines that would assist producers in voluntarily labeling both biotech and non-biotech foods in a way that is not misleading to consumers.⁵³

The importance of private, voluntary labeling schemes should not be discounted. Much research indicates that voluntary labeling and advertising transmits useful and important information to consumers in formats they find easiest to understand.⁵⁴ Indeed, market competition among producers for providing demanded information can alert consumers to the existence of improved or better products, spur additional demand for such products, and drive consumers to gear products to the resulting consumer demand. For example, U.S. Federal Trade Commission studies of voluntary food health claims found that when food manufacturers were permitted to mention diet-disease relationships on their package labels, consumers began to reduce their dietary intake of fat, saturated fat, and cholesterol, and to increase fiber intake as a direct response to information they received from food advertising. Moreover, the resulting competition among manufacturers to provide products with the characteristics demanded by consumers (i.e. those nutritional elements) encouraged more manufacturers to produce and sell healthier foods.⁵⁵

The First Amendment and the Constitutionality of Labeling

Despite the availability of alternative sources of information about genetic status, labeling advocates have still challenged the Food and Drug Administration's policy on the labeling of bioengineered foods. Oregon's Ballot Measure 27 is not the first attempt to require labeling. When the FDA approved recombinant bovine somatotropin (rbST) in 1993, anti-biotechnology advocates de-

The U.S. Second Circuit Court of Appeals held that food labeling cannot be mandated simply because some people would like to have the information.

To ensure accuracy in labeling an elaborate system of separation and record-keeping would have to be imposed so that every single ingredient or additive in every food product can be traced through every step of the food chain — from breeder, to farmer, to shipper, to processor, and to retailer.

mandated that all dairy products from cows treated with rbST be labeled as “bioengineered” or “genetically modified.” When the FDA refused, activists turned their efforts toward lawsuits and state legislatures—with variable degrees of success.

A group of Wisconsin consumers sued the FDA, arguing that the agency’s decision not to require the labeling of dairy products from cows treated with the bioengineered hormone allowed those products to be labeled in a false and misleading manner. In *Stauber v. Shalala*⁵⁶ the plaintiffs could not actually demonstrate any material difference between milk from treated and un-treated cows. Thus, the federal District Court for the Western District of Wisconsin ruled, because the dairy products in question did not differ in a significant way, “it would be misbranding to label the product[s] as different, even if consumers misperceived the product[s] as different.”⁵⁷

In Vermont, activists convinced the state legislature to enact a law requiring that, “[i]f rbST has been used in the production of milk or a milk product for retail sale in [Vermont], the retail milk or milk product shall be labeled as such.”⁵⁸ In the 1996 case, *International Dairy Foods Association, et al. v. Amestoy*,⁵⁹ the U.S. Second Circuit Court of Appeals noted that a labeling mandate grounded in consumer perception, rather than in a product’s measurable characteristics, raises serious constitutional concerns. The court held that food labeling cannot be mandated simply because some people would like to have the information. Both the labeling statute and companion regulations were ruled unconstitutional because they forced producers to make involuntary statements contrary to their views when they sold dairy products from cows treated with rbST.

The Court held, “The right not to speak inheres in political and commercial speech alike ... and extends to statements of fact as well as statements of opinion.”⁶⁰ Because the State of Vermont could not demonstrate that its interest in compelling acknowledgment of rbST use represented anything more than satisfying consumer curiosity, it could not compel milk producers to include that information on product labels. In the words of the court:

“We are aware of no case in which consumer interest alone was sufficient to justify requiring a product’s manufacturers to publish the functional equivalent of a warning about a production method that has no discernable impact on a final product. ... Absent some indication that this information bears on a reasonable concern for human health or safety or some other sufficiently substantial governmental concern, the manufacturers cannot be compelled to disclose it. Instead, *those consumers interested in such information should exercise the power of their purses by buying products from manufacturers who voluntarily reveal it*” [emphasis added].⁶¹

In other words, to be constitutional, labeling mandates must be narrowly tailored to providing information that serves a genuine public interest. In the case of food products, this will typically mean that label mandates must be confined to requiring disclosure of information that is relevant to health or nutrition.

If approved, Oregon Ballot Measure 27 would require all bioengineered foods to be labeled, despite a finding of safety by the Food and Drug Administration. Yet in *Stauber v. Shalala* and *International Dairy Foods Association v. Amestoy*, two separate courts found that consumer interest and the public’s “right

to know” were not sufficient grounds for compelling speech. For this same reason the Oregon food labeling initiative also raises serious constitutional questions, and it would likely fail to survive a court challenge.

Other Harms of Mandatory Labels

Misleading

There are several other reasons why mandatory labeling of bioengineered foods is an unwise policy. Labels are a valuable source of information for consumers, so U.S. federal law is very clear that food product labels and other advertising information must be both truthful and not misleading. Thus, federal food labeling law prohibits label statements that are likely to be misunderstood by consumers, even if they are not technically false.⁶² For example, labeling the vegetable broccoli as being “cholesterol-free” could run afoul of the FDA’s rules because no broccoli contains cholesterol. Consequently, such a label statement could suggest to consumers that, though the labeled broccoli is cholesterol-free, other broccoli is not.⁶³

Similarly, instead of serving an educational or “right to know” purpose, mandatory labels on biotech foods could be misunderstood by consumers as a warning about some important difference. For example, one legitimate concern about mandatory labeling of all bioengineered foods is that the mere requirement of a label could be misconstrued by some consumers to suggest that biotech-derived foods differ in an important way (such as safety or nutrition) when they do not.⁶⁴

Information Overload

Another often-neglected problem of mandatory labels is that of “information overload” or the “crowding out” of important information. Many consumers turn to food labels to get important information about such things as nutrient and fat content, the presence of certain allergens, or even proper storage and preparation information. Each of these bits of information can have a material effect on consumer health. The appearance on a food product label of too much information about materially irrelevant facts—those not pertaining to legitimate issues of health—can make it more difficult for consumers to locate important facts about the foods they consume.

Indeed, the appearance of too much information increases the risk that consumers will pay less attention to individual messages within labels, making it more difficult to transmit information regarding real hazards.⁶⁵ Federal laws already mandate that all sorts of information be included on packaged food labels, but few people actually take the time to read every bit of the tightly printed lists. A similar problem exists with labels for over-the-counter and prescription drugs. As a Michigan appeals court noted in *Dunn v. Lederle Laboratories*, “[m]aking consumers account mentally for trivia or guard against risks that are not likely to occur imposes a very real societal cost.”⁶⁶ It is precisely because food labels are such an important source of consumer information that packagers should not be forced to include material that does not serve a specific and necessary purpose.

One study calculated that a proposed Canadian labeling mandate would be expected to raise the retail price of processed foods by at least nine to ten percent.

The Oregon Department of Administrative Services estimates that the state's costs to enforce labeling compliance—paid by Oregon taxpayers—would be more than \$11.2 million per year, with additional start-up costs of over \$6.3 million during the first year.

Cost Shifting and the Price of a Labeling Mandate

Although the introduction of a labeling mandate for all bioengineered food products might appear as though it would cost very little, the costs would actually be quite high—requiring more than simply changing labels. To provide accurate information, and to guarantee compliance, elaborate systems of segregating bioengineered foods from non-engineered foods in all stages of production (including seed development, planting, harvesting, distribution, processing, and packaging) would be necessary.

Much of the cost involved in labeling bioengineered foods comes from the fact that biotech and non-biotech products are often indistinguishable from one another. This is true even for most freshly harvested foods, because the bioengineered traits are typically not obvious from visual inspection. Segregation becomes even more difficult for processed food products like cooking oils, sugars and other sweeteners, cheeses, and fermented beverages, because the processing itself tends to break down the proteins and DNA strands that are the only evidence of bioengineered origin. For example, soybean oil is indistinguishable regardless if it comes from conventional soybeans, organic soybeans, or bioengineered soybeans.

Consequently, to ensure accuracy in labeling an elaborate system of separation and record-keeping would have to be imposed so that every single ingredient or additive in every food product can be traced through every step of the food chain—from breeder, to farmer, to shipper, to processor, and to retailer. Such segregation and “traceability” requires extensive DNA and protein testing at each step of the food production process, as well as building a superfluous duplicate

network of grain elevators, processing mills, and storage facilities. In addition, new methods of third-party verification (government or private sector) will probably be demanded. The considerable cost for each of these services will have to be borne by both food producers who use bioengineered ingredients and those who do not. Under various labeling proposals the failure to label a product with bioengineered ingredients typically results in criminal penalties. Under Oregon Ballot Measure 27 a failure to properly label any food product would be punishable by fines of up to \$5,000 and up to six months in jail for each package.⁶⁷ So, producers who do not use biotech-derived ingredients will have to ensure that no bioengineered products are accidentally introduced into their own supply chains.

In a study commissioned by the University of Guelph in Ontario, Canada, KPMG Consulting estimated that a proposed labeling mandate would raise the cost of producing, handling, shipping, and processing bioengineered commodity grains by approximately 35 to 41 percent (the estimated cost increase to farmers alone would be approximately 14 percent). Because the cost of such grains accounts for about one-fourth of the total costs associated with generating the average processed-food product, the study further calculated that a labeling mandate would be expected to raise the retail price of processed foods by at least nine to ten percent.⁶⁸ Similarly high cost estimates were found in another KPMG study commissioned by the Australia/New Zealand Food Authority,⁶⁹ and in an econometric literature survey conducted by researchers in the European Union's Directorate General for Agriculture.⁷⁰ Additional costs of similar magnitude would be expected for producers of non-biotech foods, because every ingredient will still need to be tested for “purity” at each step of the production process.

Despite even these considerable effects, the cost to Oregon consumers of this labeling rule would not end after retail purchases have been made. The Oregon Department of Administrative Services estimates that the state's costs to enforce labeling compliance—paid by Oregon taxpayers—would be more than \$11.2 million per year, with additional start-up costs of over \$6.3 million during the first year.⁷¹ To ensure that food products were labeled correctly, the Oregon Department of Agriculture would need to add additional scientific and regulatory personnel, conduct hundreds of thousands of laboratory tests on foods each year, and audit farms, food processing centers, restaurants, and other places where foods are produced and sold.

Almost all of the bioengineered crop plants currently grown by farmers are commodity grains, but numerous other crop varieties are being developed. Once additional bioengineered varieties are commercialized and are grown more commonly by farmers in Oregon and elsewhere, retail prices of whole foods and processed foods would be expected to rise even further, as would all other costs associated with producing, shipping, selling, and regulating foods in the state of Oregon.

Interestingly, the call for labeling only bioengineered foods further suggests that genuine demand for the information is actually rather low, because those calls come primarily from consumers wishing to purchase foods that are not bioengineered. One of the most important measures of true consumer demand for information is a willingness to pay for the service. After all, who would decline an opportunity to receive information when someone else is paying the bill? Segregation, certification, and labeling are not free; in fact, they are quite costly. Thus, requiring producers of bioengineered foods to label

their products affirmatively shifts much of the enormous cost of providing this information from those who are demanding it onto consumers who are not. In doing so, labeling advocates demonstrate that they are, in fact, not willing to pay the full cost for the information they wish to use in making purchasing decisions—a position that hardly seems reasonable or equitable.

Oregon's Questionable Labeling Initiative

Although there are numerous problems with bioengineered-food labeling mandates generally, there is yet another good reason for questioning Oregon Ballot Measure 27 specifically. The initiative was crafted so poorly that it will actually re-define as “genetic engineering” many breeding techniques that are not genetic engineering. Consequently, it will require many foods accepted even by biotechnology critics to be labeled as though they were genetically engineered. Most varieties of the cereal grains and other crops grown in the state of Oregon could be classified as “genetically engineered” under the ambiguous definition in Measure 27, even though they are not, subjecting those products to the same needless and expensive labeling rules that would apply to actual products of bioengineering. Furthermore, requiring many non-bioengineered products to be labeled as “genetically engineered,” counteracts the alleged purpose of the labeling requirement: enabling consumers to differentiate between genetically engineered and non-genetically engineered foods.

According to the ballot initiative text, the term “Genetically Engineered” means anything that is “grown, manufactured, processed or otherwise produced or altered with techniques that change the molecular or cell biology of an organism by means or in a

Literally tens of thousands of conventional plant varieties that are currently being grown all around the world, comprising the majority of the plant foods we eat every day, were bred with older techniques that would be reclassified as “genetic engineering” by this poorly written definition.

An honest observer has to conclude that the drafters of Measure 27 were either completely unaware of some of the most basic concepts in plant and animal breeding or were primarily motivated by hostility to certain modern agriculture technologies and practices. Neither alternative is a valid basis upon which to build public policy.

manner not possible under natural conditions or processes.” That definition probably seems just about right for critics of biotechnology, but what most of them probably do not understand is that not all breeding techniques that are “unnatural” involve bioengineering—what scientists call “recombinant DNA engineering.”

In fact, Measure 27 would apply the labeling mandate to foods produced with many techniques that were being used by breeders for decades before the methods of bioengineering were first developed in the early 1970s. The ballot measure specifies that the legal definition of “genetic engineering” is “not limited to recombinant DNA techniques.” It also explicitly includes such techniques as “cell fusion, micro- and macro encapsulation, gene deletion and doubling, introducing a foreign gene, and changing the positions of genes.” Although bioengineering has been used to alter plants for the past two decades, relatively few biotech varieties are grown commercially. However, literally tens of thousands of conventional plant varieties that are currently being grown all around the world, comprising the majority of the plant foods we eat every day, were bred with older techniques that would be reclassified as “genetic engineering” by this poorly written definition.

The mutation breeding and wide-cross hybridization techniques mentioned in an earlier section of this paper are just two examples of non-biotech breeding processes “not possible under natural conditions.” Although these processes are not “natural,” neither one is generally considered to be “genetic engineering” even by the technology’s fiercest critics. After all, wide-cross hybridization to produce improved varieties of such plants as oats, potato, rice, tomato, wheat, and many others, has been in common use in the United

States and abroad since the early part of the 1900s. Many, if not most, of the bread wheat and durum pasta wheat varieties grown by farmers in the United States are the products of wide-cross breeding programs in which different species of plants (some even from an entirely different genus) such as ryegrass, or weed species such as goatgrass or couchgrass, were artificially mated with wheat.⁷²

When producing wide-crosses, artificial hybrids can be created from two plants that typically would be sexually incompatible. The plant embryos—a fertilized seed—created by these forced matings usually will die prior to maturation. Before they die, then, the plant embryos must be “rescued” and cultured in a laboratory environment. Even when such rescued embryos do grow to maturation, they typically produce sterile offspring, which can occasionally be made fertile again by using still other techniques to add additional sets of chromosomes.⁷³ The plant triticale, an artificial hybrid of wheat and rye, is one such example of a wide-cross hybrid made possible solely by the existence of embryo rescue and chromosome doubling techniques.⁷⁴ This entirely new species generally produces higher yields and superior protein content than wheat, tends to be hardier than wheat, and is grown as food or animal feed in numerous countries—but it is completely unnatural.⁷⁵ Many other such “unnatural” combinations are grown commercially in the U.S and abroad, and are often used in breeding programs to produce additional new varieties. Many of the wheat varieties currently grown in Oregon and elsewhere are either the first generation products of wide crosses and/or chromosome doubling, or have been bred from such varieties.⁷⁶

Mutation breeding has been in common use since the 1950s, and more than 2,250 known mutant varieties have been bred in at least 50 countries, including the United States.⁷⁷ Many of these are still being grown, and most have been used at one time or another as parental lines for other commercial varieties that are now planted all around the world. Even today, plant breeders at Oregon State University in Corvallis are using a wheat strain produced with chemical mutation techniques to breed new herbicide-resistant wheat varieties for Oregon farmers.⁷⁸

Weeds are especially problematic for wheat growers. In addition to tremendous annual losses in productivity and quality, weed control problems in Oregon have slowed the adoption of more sustainable management practices, such as no-tillage cultivation, which increases organic matter in soils, contributes to higher and more stable yields, and significantly reduces erosion, a serious environmental problem. Consequently, adoption of the new wheat varieties would be extremely useful for Oregon farmers and beneficial for the environment. In addition, these conventional varieties would have the added benefit of avoiding the stigmatization of biotechnology. But the OSU plant breeders could wake up the morning after Election Day to find that their conventional wheat variety has been legally re-defined as “genetically engineered,” striking a serious blow against years of intense research into producing a better, non-biotech crop.

Why have the authors of this food labeling initiative erred so wildly in defining “genetic engineering”? Can it be simply that they oppose “unnatural” modifications of our food supply? Those few methods that are specifically exempted from the labeling mandate include “breeding, conjugation, fermentation, hybridization, in-vitro fertilization and

tissue culture processes.” But certainly in-vitro fertilization and tissue culture processes, both of which can only take place under careful scientific controls in a laboratory environment, are no more “natural” than the forced mating of two sexually incompatible plant species. And, as discussed above, the reason cannot be health or safety concerns, because scientific bodies have found bioengineering to be at least as safe, and possibly safer, than conventional methods. An honest observer has to conclude that the drafters of this initiative were either completely unaware of some of the most basic concepts in plant and animal breeding or were primarily motivated by hostility to certain modern agriculture technologies and practices. Neither alternative is a valid basis upon which to build public policy.

Conclusion

Bioengineering and recombinant DNA techniques have been used to develop crops with traits that increase yields and allow farmers to reduce their use of synthetic pesticides and herbicides.⁷⁹ The technology has made substantial contributions to the production of safe, inexpensive, and healthy foods.⁸⁰ The next generation of products promises to provide even greater benefits to consumers, such as enhanced nutritional value and even foods that act as medicines.⁸¹ Unfortunately, opponents of this safe and important technology have convinced many consumers that mandatory labeling of bioengineered foods is necessary to give them a choice when making purchasing decisions.

Mandatory biotechnology labeling, like that included in Oregon Ballot Measure 27, is not warranted scientifically, economically, or legally. It could actually serve to mislead consumers, not provide them with important information. Dozens of scientific organiza-

Bioengineering and recombinant DNA techniques have been used to develop crops with traits that increase yields and allow farmers to reduce their use of synthetic pesticides and herbicides.

Ultimately, the monetary and non-monetary costs of a labeling mandate for bioengineered foods could all but destroy the ability of farmers to grow crops that are more environmentally friendly, the opportunity for processors to use foods and other ingredients with superior traits, and the chance for consumers to benefit from safer, healthier, and more nutritious choices.

tions have determined that bioengineered foods are at least as safe as, and are often safer than, conventional foods. Courts of law have ruled on several occasions that rules requiring similar labeling of bioengineered foods are unconstitutional. Furthermore, competition among food packagers for product sales has already given sellers an incentive to provide consumers the information they need to identify and purchase non-biotech foods.

Ultimately, the monetary and non-monetary costs of a labeling mandate for bioengineered foods could all but destroy the ability of farmers to grow crops that are more environmentally friendly, the opportunity for processors to use foods and other ingredients with superior traits, and the chance for consumers to benefit from safer, healthier, and more nutritious choices. Passage of Oregon Ballot Measure 27 would not expand choice. It would eliminate choice by precluding many farmers, processors, and consumers from sharing in the vast benefits of the bioengineering revolution.

Notes

¹ International Food Information Council, *Most Americans can Articulate Expected Benefits of Food Biotechnology* (Washington, D.C.: IFIC, November 2001); and Center for Science in the Public Interest/ Bruskin Research, “National Opinion Poll on Labeling of Genetically Modified Foods,” (Washington, D.C.: Center for Science in the Public Interest, April 2001).

² California Council on Science and Technology, *Benefits and Risks of Food Biotechnology* (Riverside, Cal.: California Council on Science and Technology, 2002).

³ International Food Information Council, *Most Americans can Articulate Expected Benefits of Food Biotechnology*.

⁴ See, for example, Donna U. Vogt, “Labeling of Genetically Modified Foods,” CRS Report for Congress (Washington, D.C.: Congressional Research Service, January 18, 2001).

⁵ See, for example, National Academy of Sciences, *Introduction of Recombinant DNA-Engineered Organisms into the Environment: Key Issues* (Washington, D.C.: Council of the U.S. Academy of Sciences/ National Academy Press, 1987); American Medical Association, “Report 10 of the Council on Scientific Affairs (I-00): Genetically Modified Crops and Foods,” (Chicago, Ill.: American Medical Association, 2000). Available at: <<http://www.ama-assn.org/ama/pub/article/2036-3604.html>>; Institute of Food Technologists, *IFT Expert Report on Biotechnology and Foods* (Chicago, Ill.: Institute of Food Technologists, 2000); and World Health Organization, *Strategies for Assessing the Safety of Foods Produced by Biotechnology: Report of a Joint*

FAO/WHO Consultation (Geneva, Switzerland: World Health Organization, 1991).

⁶ James H. Maryanski, “FDA’s Policy for Foods Developed by Biotechnology,” in *Genetically Modified Foods: Safety Issues*, Engel, Takeoka, and Teranishi, eds., American Chemical Society, Symposium Series No. 605 (1995), pp. 12-22.

⁷ Center for Veterinary Medicine of the U.S. Food and Drug Administration, “BST Update,” CVM Update (March 21, 1996).

⁸ Center for Food Safety and Applied Nutrition of the U.S. Food and Drug Administration, “Biotechnology of Food,” FDA Backgrounder (May 18, 1994).

⁹ Food and Drug Administration, “List of Completed Consultations on Bioengineered Foods,” Food and Drug Administration website. Available at: <<http://www.cfsan.fda.gov/~lrd/biotechm.html#prod>>.

¹⁰ USDA National Agricultural Statistics Service, *Acreage* (Washington, D.C.: National Agricultural Statistics Service, U.S. Department of Agriculture, June 29, 2001).

¹¹ Clive James, *Global Status of Commercialized Transgenic Crops: 2001*, ISAAA Issue Brief, No. 24-2001 (Ithaca, N.Y.: International Service for the Acquisition of Agri-Biotech Applications, 2001).

Note that no varieties of bioengineered crops have been approved for commercial cultivation in Brazil. However, farmers there believe they are put at a competitive disadvantage relative to their Argentine neighbors who may legally grow biotech varieties. Thus, smuggling of bioengineered soybean seed from Argentina is rampant

and, by one estimate, Brazil is now the fifth largest grower of bioengineered crops. See, for example, European Commission Directorate General for Agriculture, "Economic Impacts of Genetically Modified Crops on the Agri-Food Sector: A First Review," Working Document, Revision 2 (Brussels: Commission of the European Communities, 2000).

¹² Institute of Food Technologists, *IFT Expert Report on Biotechnology and Foods* (Chicago, Ill.: Institute of Food Technologists, 2000).

¹³ Pew Initiative on Food and Biotechnology, *Harvest on the Horizon: Future Uses of Agricultural Biotechnology* (Washington, D.C.: Pew Initiative on Food and Biotechnology, September 2001).

¹⁴ Robert M. Goodman, Holly Hauptli, Anne Crossway, and Vic C. Knauf, "Gene Transfer in Crop Improvement," *Science*, Vol. 236 (April 3, 1987), pp. 48-54.

¹⁵ Ibid.

¹⁶ Alan MacHughen, *Pandora's Picnic Basket: The Potential and Hazards of Genetically Modified Foods* (New York: Oxford University Press, 2000).

¹⁷ International Atomic Energy Agency, *Officially Released Mutant Varieties: The FAO/IAEA Database* (Vienna, Austria: Joint FAO-IAEA Division, International Atomic Energy Agency, December 2000).

¹⁸ Robert M. Goodman, et al., "Gene Transfer in Crop Improvement."

¹⁹ International Atomic Energy Agency, *Officially Released Mutant Varieties: The FAO/IAEA Database*.

²⁰ American Medical Association, "Report 10 of the Council on Scientific Affairs (I-00): Genetically Modified Crops and Foods."

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²³ National Academy of Sciences, *Introduction of Recombinant DNA-Engineered Organisms in the Environment: Key Issues*.

²⁴ National Research Council, *Field Testing Genetically Modified Organisms: Framework for Decisions* (Washington, D.C.: National Academy Press, 1989), p. 13.

²⁵ National Research Council, *Genetically Modified Pest-Protected Plants: Science and Regulation* (Washington, D.C.: National Academy Press, 2000); Royal Society of London, the U.S. National Academy of Sciences, the Brazilian Academy of Sciences, the Chinese Academy of Sciences, the Indian National Science Academy, the Mexican Academy of Sciences and the Third World Academy of Sciences, *Transgenic Plants And World Agriculture* (Washington, D.C.: National Academy Press, 2000); and National Research Council, *Environmental Effects of Transgenic Plants: Scope and Adequacy of Regulation* (Washington, D.C.: National Academy Press, 2002).

²⁶ National Research Council, *Genetically Modified Pest-Protected Plants: Science and Regulation*.

²⁷ Institute of Food Technologists, *IFT*

Expert Report on Biotechnology and Foods; and National Research Council, *Genetically Modified Pest-Protected Plants: Science and Regulation.*

²⁸ See, for example, Center for Science in the Public Interest/Bruskin Research, “National Opinion Poll on Labeling of Genetically Modified Foods.”

²⁹ *Ibid.* In this survey, 70 percent of respondents agreed that “the words genetically engineered should appear on the label of a food product where one or more ingredients were genetically engineered.” Yet 25 percent of respondents admitted that they were “not at all familiar” with genetically engineered foods, 30 percent said “not very familiar,” 38 percent said “somewhat familiar,” and only 5 percent said they were “extremely familiar.”

³⁰ *Ibid.*

³¹ Food and Drug Administration, “Statement of Policy: Foods Derived From New Plant Varieties,” Federal Register, Vol. 57 (May 29, 1992), pp. 22,984-23,005.

³² Food and Drug Administration, “Interim Guidance on the Voluntary Labeling of Milk and Milk Products From Cow That Have Not Been Treated With Recombinant Bovine Somatotropin,” Federal Register, Vol. 59 (February 10, 1994), pp. 6,279-6,280.

³³ Food and Drug Administration, “Statement of Policy: Foods Derived From New Plant Varieties.”

³⁴ American Medical Association, “Report 10 of the Council on Scientific Affairs (I-00): Genetically Modified Crops and Foods.”

³⁵ Institute of Food Technologists, *IFT Expert Report on Biotechnology and Foods.*

³⁶ International Food Information Council, *Most Americans can Articulate Expected Benefits of Food Biotechnology.* In March 1997, 78 percent of respondents said they supported FDA’s current policy, as did 78 percent in February 1999, 69 percent in October 1999, 69 percent in May 2000, 70 percent in January 2001, and 57 percent in September 2001.

³⁷ Karen K. Marshall, “What ’s in a Label?” *AgBioForum*, Vol. 1, No. 1 (Summer 1998), pp. 35-37. It should be noted that, while the FlavrSavr tomato eventually was removed from the market, this is usually attributed to the use of inferior tomato varieties, rather than consumer rejection of bioengineering.

³⁸ George Gaskell, Edna Einsiedel, Susanna Priest, Toby Ten Eyck, Nick Allum, and Helge Torgersen, “Troubled waters: the Atlantic divide on biotechnology policy,” in *Biotechnology 1996-2000*, George Gaskell and Martin W. Bauer eds. (London: Science Museum, 2001), pp. 96-115.

³⁹ European Commission Directorate General for Agriculture, “Economic Impacts of Genetically Modified Crops on the Agri-Food Sector: A First Review.”

⁴⁰ Agriculture & Biotechnology Strategies, Inc., “GMO Database,” on-line database of bioengineered plant approvals (Accessed September 23, 2002). Available at: <<http://64.26.172.90/agbios/database.php?action=ShowForm>>.

⁴¹ Peter W.B. Phillips and Grant Isaac, “GMO Labeling: Threat or Opportunity?” *AgBioForum*, Vol. 1, No. 1 (Summer 1998),

pp. 25-30.

⁴² See, for example, C. Ford Runge and Lee Ann Jackson, "Negative Labeling of Genetically Modified Organisms (GMOs): The Experience of rBST," *AgBioForum*, Vol. 3, No. 1 (Winter 2000), pp. 310-314; and Michael I. Krauss, "Regulation vs. Markets in the Development of Standards," *Southern California Interdisciplinary Law Journal*, Vol. 3, No. 3 (Summer 1994), pp. 781-807.

⁴³ See, for example, Michael I. Krauss, "Loosening the FDA's Drug Certification Monopoly: Implications for Tort Law and Consumer Welfare"; and Karen Ruth Lavy Lindsay, "Comment: Can Kosher Fraud Statutes Pass the Lemon Test?: The Constitutionality of Current and Proposed Statutes," *University of Dayton Law Review*, Vol. 23, No. 1 (Winter, 1998), pp. 337-369.

⁴⁴ Anon. "Organic farming: Let's keep it clean," *The Economist* (April 17, 1999) pp. 34-35; and Organic Trade Association, *American Organic Standards: Guidelines for the Organic Industry*, compiled by James A. Riddle, Emily Brown Rosen, and Lynn S. Coody (Greenfield, Mass.: Organic Trade Association, October 20, 1999).

⁴⁵ Organic Foods Production Act, 7 USC 6,501 et seq.

⁴⁶ U.S. Department of Agriculture, "National Organic Program: Final Rule with Request for Comments," 7 CFR Part 205.

⁴⁷ *Ibid.*

⁴⁸ See, for example, C. Ford Runge and Lee Ann Jackson, "Negative Labeling of Genetically Modified Organisms (GMOs): The Experience of rbST."

⁴⁹ See, Ben & Jerry's company website at: <<http://www.benandjerrys.com>>.

⁵⁰ Genetic ID, "New Company Forms to Provide Enhanced Consumer Safeguards for Food," company press release (January 28, 1999).

⁵¹ Genetic Food Alert, "GM-Free Food Products Database," on-line database. Available at: <<http://www.geneticfoodalert.org.uk>>.

⁵² See, for example, Greenpeace International website at: <<http://www.greenpeace.org/homepage>>.

⁵³ Food and Drug Administration, Daft Guidance for Industry: Voluntary Labeling Indicating Whether Foods Have or Have Not Been Developed Using Bioengineering."

⁵⁴ See, for example, George Stigler, "The Economics of Information," *Journal of Political Economy*, Vol. 69 (1961), pp. 213-225; and Pauline M. Ippolito, "Consumer Protection Economics: A Selected Survey," in *Empirical Approaches to Consumer Protection Economics*, Pauline M. Ippolito and David T. Scheffman, eds. (Washington, D.C.: Federal Trade Commission, 1986), pp. 1-33.

⁵⁵ Pauline M. Ippolito and Alan D. Mathios, *Information and Advertising Policy: A Study of Fat and Cholesterol Consumption in the United States, 1977-1990*, Bureau of Economics Staff Report (Washington, D.C.: Federal Trade Commission, September 1996); and Pauline M. Ippolito and Alan D. Mathios, *Health Claims in Advertising and Labeling: A Study of the Cereal Market*, Bureau of Economics Staff Report (Washington, D.C.: Federal Trade Commission,

1989).

⁵⁶ *Stauber v. Shalala*, 895 F. Supp. 1178 (W.D. WI, 1995).

⁵⁷ *Ibid.*, p. 1193.

⁵⁸ Vt. Stat. Ann. tit. 6, § 2754(c).

⁵⁹ *International Dairy Foods Association, et al. v. Amestoy*, 92 F.3d 67 (2nd Cir. 1996).

⁶⁰ *Ibid.*, p. 71.

⁶¹ *Ibid.*, p. 74.

⁶² Federal Food, Drug and Cosmetics Act, 21 U.S.C § 343(a)(1).

⁶³ Institute of Food Technologists, *IFT Expert Report on Biotechnology and Foods*.

⁶⁴ Food and Drug Administration, “Statement of Policy: Foods Derived From New Plant Varieties.”

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See also *Finn v. G.D. Searle & Co.* 35 Cal. 3d 691, 701 (Cal., Mar. 29, 1984).

⁶⁷ Coalition Against the Costly Labeling Law, “Why Oregonians are joining together to urge NO on Measure 27,” pamphlet (Portland, Or.: Coalition Against the Costly Labeling Law, 2002). Note that the Coalition Against the Costly Labeling Law is an organization created to oppose Oregon Ballot Measure 27.

⁶⁸ Geoff Golder, Flavia Leung, and Sebastien Malherbe, “Economic Impact Study: Potential Costs of Mandatory Labelling of Food Products Derived from Biotechnology in Canada,” KPMG Consulting (2000).

⁶⁹ Anon. “Preliminary Report: Compliance Costs for Labeling Biotech Foods Prepared for Australia/New Zealand Food Authority,” KPMG Consulting (1999).

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⁷¹ Laurie Byerly, “Memo: Labeling of Genetically Engineered Foods,” Oregon Department of Administrative Services (July 22, 2002).

⁷² Robert M. Goodman, et al., “Gene Transfer in Crop Improvement”; and Maarten Koornneef and Piet Stam, “Changing Paradigms in Plant Breeding,” *Plant Physiology*, Vol. 125, No. 1 (January 2001), pp. 156-159.

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⁷⁵ See, for example, Brigham Young University Department of Plant and Animal Sciences website at: <<http://pas.byu.edu>>.

⁷⁶ Professor Jim Peterson, Department of Crop and Soil Science, Oregon State University. Personal communication with the author (September 10, 2002).

⁷⁷ International Atomic Energy Agency, *Officially Released Mutant Varieties: The FAO/IAEA Database*; and Alan MacHuguen, *Pandora’s Picnic Basket: The Potential and Hazards of Genetically Modified Foods*.

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⁷⁹ See, for example, Leonard P. Gianessi and Janet E. Carpenter, *Agricultural Technology: Insect Control Benefits* (Washington, DC: National Center for Food and Agriculture Policy, 1999); and Economic Research Service of the U.S. Department of Agriculture, *Bioengineered Crops for Pest Management* (October 27, 1999). Available at: <<http://www.econ.ag.gov/whatsnew/issues/biotech>>.

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