Modification and Consumer Information: Modern Biotechnology and the Regulation of Information

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I. Introduction

For millennia, mankind has been developing ever more useful organisms for food and other raw materials through genetic modification. In addition to yielding a fine condiment, for example, the simple mustard plant was modified to produce vegetables as different as broccoli, brussel sprouts, cauliflower, and cabbage. In the last few years, however, scientists have learned to manipulate the genetic composition of different organisms with more specificity, and greater speed, than conventional techniques ever would allow. As a result, mundane plant and animal husbandry has become something new, and to some, disconcerting — genetic engineering.

Concerns about modern biotechnology have provoked a wide range of regulatory proposals. Early uses of genetic engineering were restricted in the United States. As evidence emerged that the techniques of biotechnology are not intrinsically dangerous, more flexible regulatory approaches have evolved. Nonetheless, some would prefer to ban genetically modified organisms (GMOs) entirely, particularly when they are released into the environment. Others have proposed various labeling schemes, either voluntary (e.g., GMO free) or mandatory (e.g., "contains genetically modified soy" or "contains soy genetically modified to increase herbicide resistance"), to identify the products of modern biotechnology to consumers.[1]

The appropriate regulatory responses to GMOs or GMO-derived food ingredients in food and other consumer products, depend on the nature of GMOs and consumer interest in the development and diffusion of modern biotechnology. This article addresses these issues, arguing that special labeling for GMOs is unjustified. The article assumes that genetically modified (GM) agricultural products have been and will be produced; it does not address environmental impacts or environmental regulatory issues. Rather, it considers how to regulate information about GMOs in the food supply.

The article first analyzes the nature of modern biotechnology and the types of biotechnology products on the market or on the horizon. Then labeling issues are addressed, beginning with the rationales that have been offered for labeling, and continuing with an analysis of the choice between mandatory and voluntary labeling and the costs associated with mandatory labeling. Some costs would result from the need to separate biotechnology products from other products and other costs result from the additional information that would be included on product labels. A final section summarizes the issues, arguments, and conclusions presented.

II. The Nature of Modern Biotechnology

The results of modern biotechnology are not fundamentally different from old methods of selective breeding. Desirable characteristics of one organism are combined with

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[1] *See, e.g.*, Kirsten S. Beaudoin, *On Tonight's Menu: Toasted Cornbread with Firefly Genes? Adapting Food Labeling Law to Consumer Protection Needs in the Biotech Century*, 83 Marq. L. Rev. 237 (1999).

desirable characteristics from another. Within a species, conventional techniques use cross-fertilization to produce these combinations. Long before modern biotechnology, so-called "wide crosses" across species, and even across genera, made use of tissue culture techniques to produce genetic combinations that could not occur in nature.[2] The products of these techniques, including widely used varieties of tomato, potato, corn, oats, sugar beets, wheat, and rice, have been in use for decades, without provoking regulatory responses or demands for special labels.[3] Thus, compared to their conventional progenitors, virtually all foods in the modern diet are "genetically modified."

Modern biotechnology began in the 1970s with the development of recombinant deoxyribonucleic acid (rDNA) techniques. Using this technology, selected genetic material is removed from one organism and inserted into another. Rather than taking large, random samples of genetic material and searching for a lucky combination that includes the desirable properties of both organisms, rDNA techniques allow rapid production of precisely the desired genetic combination. The resulting GMOs have been the focus of intense and growing controversy.

From a scientific perspective, certain general observations can be made about the risks posed by the products of modern biotechnology. The struggle for survival has led plants to evolve a wide variety of chemical weapons, many of which are present naturally in food products — Americans consume an estimated five to ten thousand natural pesticides averaging 1500 milligrams per day.[4] Entirely conventional selective breeding of plants for disease or insect resistance can change the amounts of these chemicals.[5] Nonetheless, decades of safe use of the products of conventional breeding indicate that there is little reason for concern about these GM foods.

The products of modern biotechnology are no different and do not pose unique or novel risks. A National Academy of Sciences white paper,[6] and a special report by the National Research Council,[7] both concluded that the risks of modern biotechnology products can be regulated effectively in the same manner as similar products that result from older techniques of genetic manipulation. Similarly, the Expert Consultation of the Food and Agriculture Organization concluded that "food safety considerations regarding organisms produced by techniques . . . such as rDNA technology are basically of the same nature as those that might arise from other ways of altering the genome of an organism, such as conventional breeding."[8] Organisms modified through rDNA techniques typically present both a high degree of familiarity, and less uncertainty about the likely consequences of the product, than functionally similar products of older technologies. Consistent with this scientific consensus, the Food and Drug Administration (FDA) approaches biotechnology products as it would any similar product produced by other techniques. The means of production is not relevant to the regulatory scheme.

Regulation in the European Community (EC) has not been so benign. Although two transgenic crops, pesticide resistant soybeans and insect resistant corn, have been

[2] Henry Miller, *Food Produced with New Biotechnology: Can Labeling Anti-Consumer?* 14 J. PUB. POL'Y & MKTG. 330 (1995).

[3] *See* HENRY I. MILLER, POLICY CONTROVERSY IN BIOTECHNOLOGY: AN INSIDER'S VIEW 15 (1997).

[4] Bruce N. Ames, *Science and the Environment*, 43 FREEMAN 343 (1993).

[5] For example, conventional breeding techniques have produced celery with high levels of the natural carcinogen psoralen, and potatoes with high levels of solanine, a natural pesticide. Frank B. Cross, *Paradoxical Perils of the Precautionary Principle*, 52 WASH. & LEE L. REV. 851, 873 (1996).

[6] NATIONAL ACADEMY OF SCIENCES, INTRODUCTION OF RECOMBINANT DNA-ENGINEERED ORGANISMS INTO THE ENVIRONMENT: KEY ISSUES (1987).

[7] NATIONAL RESEARCH COUNCIL, FIELD TESTING GENETICALLY MODIFIED ORGANIMS: FRAMEWORK FOR DECISIONS (1989).

[8] JOINT FOOD AND AGRICULTURE ORGANIZATION/WORLD HEALTH ORGANIZATION CONSULTATION, BIOTECHNOLOGY AND FOOD SAFETY (1996) (last visited Feb. 15, 2000) <www.fao.org/es/esn/biotech/conclude.htm>.

approved for marketing, less than 500,000 acres in Europe were planted with these crops (compared to 51.25 million acres in the United States).[9] Although EC regulations acknowledge that there were no safety grounds for labeling these products, they nonetheless require that the product be labeled as "produced from genetically modified" corn or soy in the list of ingredients.[10] Moreover, if a food or ingredient that is the product of a GMO is not "equivalent" to the conventional product, the label must indicate the characteristics of the product that were modified "together with the method by which that characteristic or property was obtained."[11]

Three different categories of uses of GMOs have been identified.[12] First, most current GM crops differ from conventional varieties in "input" traits, such as insect resistance or herbicide tolerance. These differences are primarily of interest to farmers. Although genetic modification in the final product may be detectable in the laboratory, "input" traits do not alter substantially the characteristics of the product or affect how consumers (or processors) would use it.

A second generation of GM crops is beginning to emerge, with changes that materially alter product characteristics. These are "quality" traits. Monsanto, for example, is marketing a high laurate canola oil as a replacement for cocoa butter and as a dairy replacement in whipped topping.[13] It also is developing a soybean that will yield a high-stearate oil, which will allow production of margarine that does not contain trans fatty acids.[14]

A third category of ingredients based on GMOs is "biofactories." In these applications, a GMO is used to produce a product that conventionally is produced by other means. Bacteria, for example, have been modified genetically to produce the enzyme rennin, used in the production of cheese.[15] Numerous drugs and biologics have been approved that are produced using GMOs, including, for example, human insulin and hepatitis B vaccine.[16] At present, most "biofactory" applications involve micro-organisms, but research is under way to develop GM plants and animals to produce pharmaceuticals and other products.

III. SPECIAL LABELING FOR GMOS

Any consideration of special labeling of GMOs must recognize that *all* modern crops are modified genetically. In the case of corn, for example, the modern agricultural crop is so different from its "natural" ancestors that its origins were in dispute

[9] CLIVE JAMES, INTERNATIONAL SERVICE FOR THE ACQUISITION OF AGRI-BIOTECH APPLICATIONS, GLOBAL REVIEW OF COMMERCIALIZED TRANSGENIC CROPS: 1998, ISAAA BRIEFS NO. 8.

[10] EC COUNCIL REGULATION NO. 1139/98, May 26, 1998. For a discussion of how this labeling regulation emerged from the political response to the approval of genetically modified corn (maize), despite the lack of any credible health and safety risk, see Terence P. Stewart & David S. Johanson, *Policy in Flux: The European Union's Laws on Agricultural Biotechnology and Their Effects on International Trade*, 4 DRAKE J. AGRIC. L. 243 (1999).

[11] If the products are not "equivalent," the regulation would appear to require distinguishing "genetically modified pesticide resistant soy" from "genetically modified insect and pesticide resistant soy." A product no longer is equivalent if scientific assessment "can demonstrate that the characteristics assessed are different in comparison with a conventional food or food ingredient, having regard to the accepted limits of natural variations for such characteristics." EC COUNCIL REGULATION NO. 258/97 of the European Parliament and of the Council, Jan. 27, 1997, Article 8.

[12] This categorization is based on Peter A. Riley & Linwood Hoffman, *Value Enhanced Crops: Biotechnology's Next Stage*, AGRIC. OUTLOOK 18 (1999) (available at <www.econ.ag.gov/epubs/pdf/agout/mar99>) (last visited Feb. 16, 2000); *see also*, MONSANTO CO. 1997 ANNUAL REPORT 8 (1998).

[13] MONSANTO CO. 1997 ANNUAL REPORT, *supra* note 12.

[14] *Id.*

[15] T.A.B. Sanders, *Food Production and Food Safety*, 218 BRIT. MED. J. 1689 (1999).

[16] Miller, *supra* note 3, at 5.

until the advent of modern genetic analysis.[17] For centuries, plants have been selected for desirable characteristics, crossed with other plants to produce disease-, drought-, and insect-resistant varieties that never existed in nature, and even crossed with different species using tissue culture techniques.[18] The resulting plants would not have occurred in nature and probably could not survive without human intervention to provide optimal growing conditions. Nonetheless, there apparently has never been any interest in identifying such "modified" organisms in labeling.

Concerns about identifying GMOs are not about genetic modification per se. Rather, they are concerns about use of the techniques of modern biotechnology, in particular, rDNA, to produce genetic modifications. The differences among various genetic modifications are when they occurred and the precise laboratory techniques that were used to introduce them. Nonetheless, as labeling regulations in the EC indicate, the term "genetically modified" has come to mean predominantly the products of rDNA techniques.[19] The subsequent discussion of special labeling continues that usage.

A. *Rationales for Special Labeling*

A number of rationales have been advanced for special labeling of GMOs or food ingredients derived from GMOs (GMO foods). Different rationales may suggest different structures for any labeling program. First, some have argued that special labeling is necessary because of potential toxicity.[20] According to this view, labeling GMO foods would enable consumers to avoid these risks. Labeling, however, is a poorly tuned tool to address toxicity concerns. If there are toxicity problems that pose a risk to public health, those problems should be addressed directly.[21] If labeling can help to minimize the problem, the crucial information is the nature of the toxicity, not the process that introduced it into the food. Conversely, if the identification of a product that "contains GMOs" implies to reasonable consumers that there are toxicity concerns when real risks do not exist, the labeling is misleading consumers, rather than informing them.

Second, some have argued for special labeling of GMO foods because of concerns that GMOs may introduce new allergens into products where consumers would not expect them. For example, an attempt to insert genes from brazil nuts into soybeans to increase protein content also transferred allergenicity, as detected in routine tests.[22]

[17] Svante Paabo, *Neolithic Genetic Engineering*, 398 NATURE 194 (1999).

[18] Henry I. Miller, *Foods of the Future: The New Biotechnology and FDA Regulation*, 269 JAMA 910 (1993).

[19] Under EC regulations, a genetically modified organism is one produced using rDNA techniques using vector systems, direct introduction of genetic material into an organism, or cell fusion techniques where new organisms are formed "by means of methods that do not occur naturally." *See* Council Directive 90/220/EEC, Apr. 23, 1990, Article 2 (2), and Annex I (A).

[20] Gilian K. Hadfield & David Thomson, *An Information Based Approach to Labeling Biotechnology Consumer Products*, 21 J. CONSUMER POL'Y 551 (1991).

[21] Regulation of pesticide residues, for example, relies on setting tolerances for acceptable exposure levels, rather than on identifying either the possible presence of residues or the specific pesticides employed. In the absence of any specific hazard, *potential* toxicity is a limitless rationale for special labeling. Virtually any hybridized plant might have as undiscovered hazards. Indeed, humans consumed animal flesh literally for millennia before the hazards of diets high in cholesterol and saturated fat were recognized. *See* Harry Sadeghi, *Redefining the "Pest" in Pesticides: Environmental Protection or Exacerbation of Half-truths about What We Eat?* 29 U. WEST. L.A. L. REV. 327 (1998).

[22] As a practical matter, food manufacturers do not want to add unnecessary allergens to any product, and seed companies, therefore, have no incentive to market crops that would do so. GMOs that incorporate significant allergens are unlikely to survive in the marketplace, unless they offer some substantial economic advantage. The need to identify the allergen and segregate the crop would preclude modifications that offer only small advantages. Julie A. Nordlee, Steve L. Taylor, Jeffrey A. Townsend, Laurie A. Thomas & Robert K. Bush, *Identification of a Brazil-Nut Allergen in Transgenic Soybeans*, 334 NEW ENG. J. MED. 688 (1996).

Consumers who are allergic to brazil nuts, and know to avoid them, would need to know that they may also be allergic to some products containing soybeans. In this case, however, the crucial information is the nature of the added allergen, not the means by which it was incorporated in the product. For the allergic consumer, it makes no difference whether brazil nut allergens were added as an additional ingredient, or as a component of some other ingredient. What consumers need to know is that the allergens are present. Whether conventional crossbreeding, rDNA techniques, or even the mixing of perfectly conventional ingredients introduced the protein, the effects on allergic consumers will be exactly the same.[23]

Third, it has been suggested that, for both toxicity and allergenicity concerns, labeling products containing or produced from GMOs could facilitate tracing and identifying problems that are not discovered until after a product is on the market. With continued growth in the number and variety of GM crops, however, the mere fact that a product contained a GMO would offer little information of value in tracing.[24] More specific information about how the organism was modified might increase the potential for benefits, but it also would increase the varieties of agricultural commodities that must be maintained separately throughout the distribution system. As with toxicity or allergenicity concerns themselves, the most appropriate response to the problem is to fix it, rather than disclose the presence of GMOs to consumers. Tracing by manufacturers' lot numbers is more specific and has proven satisfactory in tracing outbreaks of food-borne disease. GMO labeling would add nothing to the information available to the regulatory authorities that perform the tracing.

Fourth, some maintain that GMO foods should be labeled because of a consumer's "right to know." A "right to know" could be invoked to justify labeling about any detail of the production process, from use of chemical fertilizers, to the wage rate and national origin of the workers who planted and harvested the crop, to the labor practices of the manufacturer, to the soil conservation practices of the farmer. It is impossible to list all the things that might matter to everyone. In part because the "right to know" is limitless, it also is constitutionally suspect. When Vermont appealed to the "right to know" to mandate disclosure that milk had been produced using recombinant bovine growth hormone, a federal court held that the statute and regulations violated the First Amendment.[25]

Rather than defend such an open-ended right, special labeling advocates have contended that some GMOs may raise ethical concerns. For example, animal genes may be incorporated into plants, possibly raising issues for vegetarians.[26] Why an

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[23] "Considerable similarity" was discovered in the extent to which transgenic soybeans and raw brazil nut extracts bind to the immune system proteins that mediate allergic responses. *Id*. at 690. Moreover, rDNA techniques are widely used to reproduce and study allergens. *See* R. Valenta, S. Vrtala, S. Laffer, S. Spitzauer & D. Kraft, *Recombinant Allergens*, 53 ALLERGY 552 (1998).

[24] For example, different foods might include oil from soybeans or corn, modified to increase pesticide resistance, insect resistance, or both, or modified canola, or enzymes from genetically altered bacteria. Because generic labels that the product included GMOs or ingredients produced from GMOs would be the same for all such products, they would include different potential sources of any problem that might appear.

[25] Int'l Dairy Foods Ass'n v. Amestoy, 92 F.3d 67 (2d Cir. 1996).

> "Absent, however, 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. Accordingly, we hold that consumer curiosity alone is not a strong enough state interest to sustain the compulsion of even an accurate, factual statement."

Id. at 74.

[26] Logically, such special labeling should be limited to GMOs incorporating copies of animal genes. Genes copied from other plants or bacteria would not raise the same ethical issues.

ethical issue exists, however, is unclear.[27] rDNA techniques employ copies of genes that may have originated from animals, but the resulting genetic combination is a plant, behaves as a plant, and reproduces as a plant. It does not acquire "animal-like" characteristics any more than a plant fertilized with manure does.[28] Moreover, genes that code for biologically useful molecules often have been conserved by natural selection across widely differing organisms. Bacterial DNA sequences from *E. coli*, for example, virtually are identical to sequences found in other bacteria, plants, insects, amphibians, and humans.[29] Thus, the mere fact that a plant now includes an "animal" gene is not unique to modern biotechnology. Animal genes may be the most convenient source of a particular protein, but that same protein may be found in other plant species as well.

Thus, ethical concerns about incorporating animal DNA sequences into plants may stem more from lack of understanding of what is involved with GMOs, rather than any real concern. In consumer surveys, for example, consumers frequently disapprove of hybridized plants or animals produced by entirely conventional techniques. Indeed, despite the common use of hybrids in agricultural production, one survey found that two-thirds of consumers disapproved of hybrid animals, and half found them "morally wrong."[30] If such "ethical" concerns are the basis for labeling, there is more to disclose than the presence of GMOs or GMO-derived ingredients.

Fifth, some have argued for special labeling of GMO foods on the ground that unknown risks may remain, because such products lack the extensive history of safe use that "conventional" foods possess. There is, of course, less experience with any new product, regardless of the means by which it is produced.[31] As plant breeding pioneer Luther Burbank noted in 1906, "we recently advanced our knowledge of genetics to a point where we can manipulate life in a way never intended by nature. We must proceed with utmost caution in the application of newfound knowledge."[32] Even when genetic changes in an organism are produced by entirely conventional techniques, there is the possibility of other, unwanted changes. Uncertainty about other changes that might have occurred has never justified special labeling of each new hybridized variety of common foods. Indeed, the risk of unknown changes probably are greater from conventional breeding techniques, because they involve far more genetic differences with correspondingly greater potential for unanticipated effects. As the National Academy of Sciences noted, "a mutation made by traditional techniques may be accompanied by many unknown mutations, which often have deleterious effects on the organism."[33] The greater predictability of changes made through modern biotechnology tends to reduce risks, compared to conventional breeding techniques.[34]

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[27] Of course, some may see an ethical issue regardless of the lack of a scientific foundation for the distinction. As discussed below, voluntary labeling would allow these individuals to pursue their own beliefs, but it would not require the majority who do not share those beliefs to subsidize them.

[28] Food & Drug Administration, Food Labeling: Foods Derived From New Plant Varieties, 58 Fed. Reg. 25,837, 25,839 (Apr. 28, 1993).

[29] MILLER, *supra* note 3, at 17.

[30] This and other surveys are discussed in Lona Aldrich & Noel Blisard, *Consumer Acceptance of Biotechnology: Lessons From the rBST Experience, Current Issues in Economics of Food Markets*, AGRIC. INFO. BULL. No. 747-01, (Dec. 1998).

[31] If the concern is the inherent uncertainty about a product that has not been consumed for an extended period, a disclosure more closely attuned to the problem may be that "this product has been on the market for less than *x* years." The minimal benefit of such a requirement is apparent.

[32] Thomas P. Redick, William A. Reavey & Dirk Michels, *Private Legal Mechanisms for Regulating the Risks of Genetically Modified Organisms: An Alternative Path Within the Biosafety Protocol*, 4 ENVTL. L. 1, 11-12 (1997).

[33] NATIONAL ACADEMY OF SCIENCES, *supra* note 6, at 11.

[34] NATIONAL INSTITUTES OF HEALTH, NATIONAL BIOTECHNOLOGY BOARD REP. 2 (1992).

Finally, special labeling of GMO foods has been advocated because when quality traits are involved, the product may have significantly different functional characteristics. When a familiar grain product is different in ways that may affect its use, then information for consumers is much more valuable. In such circumstances, however, the key information that consumers need is the fact of the difference, not the method used to produce that difference. Moreover, the difference would be equally significant if it was produced using entirely conventional crossbreeding techniques. If, for example, a soybean variety has a stearic acid content that differs substantially from conventional soybeans, the important fact for consumers is that a food contains higher or lower levels than they might expect ordinarily. The information might be provided through nutrition labeling that indicated the product has different characteristics, or it might be provided in the ingredients list (e.g., low stearic acid soybean oil).

Indeed, information about how the difference was produced may mislead, rather than enlighten many consumers. Knowledge that the product "contains GMOs or GMO-derived ingredients" provides no information on the particular quality characteristics that have changed and may suggest the possibility of other changes that have not occurred. Alternatively, if the label states that the product was modified genetically to achieve certain properties, the means of introducing that change adds nothing to the fact of the change. It is equally possible to identify the means of introducing other changes in characteristics (e.g., hybridized to increase protein content for corn). Any such scheme arguably would require the identification of Plato's ideal corn as the basis for comparison.[35] Changes compared to an ancient variety that no longer is cultivated, however, surely are not relevant to modern consumers. When, as discussed above, consumers apparently do not understand the nature of hybridization, it is hard to see how they could interpret correctly the implications of genetic modifications introduced by other methods.

B. *Mandatory Versus Voluntary Labeling*

Of course, consumers who are averse to risk or who are concerned about the possible environmental implications of GMOs still may wish to avoid products that contain them or ingredients derived from them. Indeed, there are numerous examples of consumers with concerns about a particular process used in food production, and products that cater to those concerns. For example, some consumers seek to avoid products grown with pesticides or chemical fertilizers, and purchase "organic" products. Other consumers prefer "free range chickens," or foods produced under the guidelines necessary to qualify as "kosher."[36] If there are enough consumers willing to pay to avoid a particular process, or to obtain a process they prefer, manufacturers have every incentive to provide those products. GMOs are no different. If advocates of labeling are correct, and some consumers do wish to avoid GMOs, some producers will cater to their demands.

Voluntary labeling was the approach that FDA adopted when it approved recombinant bovine somatotropin (rBST), a hormone that regulates a cow's milk production. When rBST was approved in 1993, FDA declined to require mandatory labeling, because there is no detectable difference between milk produced from cows treated with rBST and untreated cows.[37] Subsequently, it issued interim guidance on volun-

[35] ". . . each of these ideal qualities has a kind of existence, and the particular things that partake of them get their name from them . . ." GREAT DIALOGUES OF PLATO 506 (translated by W.H.D. Rouse, 1956).

[36] Sharon Walsh, *In the Food Industry, the New Competition is Kosher*, WASH. POST, May 30, 1998, at A1.

[37] *See* Dan L. Burk, *The Milk Free Zone: Federal and Local Interests in Regulating Recombinant BST*, 22 COLUM. J. ENVTL. L. 227 (1997). Burk includes a comprehensive discussion of the science and politics of the rBST debate.

tary claims about the absence of rBST.[38] Because a simple claim that cows were not treated with rBST could imply to consumers that the milk was safer or healthier than other milk, the guidance indicated that the label also should include a statement that "no significant difference has been shown between milk derived from rBST-treated and non-rBST treated cows."[39]

Labeling policies with respect to process-oriented preferences generally have been consistent in allowing rather than mandating label claims that a particular process was used, or not used. In the absence of specific health concerns, or material effects on the characteristics of the resulting product, regulatory policies have not required disclosure of processes that are used to produce a particular food.[40] Regulations allow producers to label some products as organic, for example; other producers are not required to disclose that crops were grown with chemical fertilizers and/or pesticides.[41] Producers who raise free range chickens may identify them; other chicken producers are not required to disclose their animal husbandry practices. And labeling kosher products is voluntary. There is no "non-kosher" labeling requirement.

When there is no scientific basis for distinguishing between products on the basis of a particular process, reliance on voluntary labeling is the most appropriate regulatory policy.[42] If consumers value the difference, then producers will provide products, and information, to meet these consumer demands. The wide range of products offered in competitive markets is ample testimony of the countless ways that similar merchandise can be differentiated, based on product features, use characteristics, convenience of packaging, or the methods of production. Competitive markets offer powerful incentives to discover the differences that matter to consumers, and to bring those differences to the consumer's attention. There is no need, and no objective basis, for identifying particular product differences that must be disclosed, in the absence of scientific evidence of meaningful distinctions. Markets are extremely adept at identifying and satisfying even the most obscure consumer preferences.

With voluntary labeling, consumers who value the information are the ones who must pay the costs associated with it; those who do not care are not burdened with the

[38] Interim Guidance on the Voluntary Labeling of Milk and Milk Products from Cows That Have Not Been Treated with Recombinant Bovine Somatotropin, 59 Fed. Reg. 6279 (Feb. 10, 1994).

[39] *Id*. at 6280. The labeling requirements, and the response of some states, are discussed in more detail in Terence J. Centner & Kyle W. Lathrop, *Labeling rBST-Derived Milk Products: State Responses to Federal Law*, 45 KAN. L. REV. 511 (1997).

[40] For example, regulations require disclosure that a fruit juice is unpasteurized, because unpasteurized products pose particular, identifiable risks. Thus, unpasteurized fruit juices must bear a label stating: "WARNING: This product has not been pasteurized and, therefore, may contain harmful bacteria that can cause serious illness in children, the elderly, and persons with weakened immune systems." *See* 21 C.F.R. §101.17(g)(2) (1996). Regulations, however, do not require disclosure of the living conditions of animals or that the cattle were treated with rBST, although some consumers might care about such differences. Animal living conditions and use of veterinary drugs have been controversial issues in the Agricultural Department's proposed rules to establish national organic standards. 62 Fed. Reg. 65,850 (Dec. 16, 1997); comments on rule *available at* <www.ams.usda/gov/nop/index.htm> (last visited Feb. 16, 2000).

[41] Organic claims are governed by the Federal Organic Foods Production Act of 1990, Pub. L. No. 101-624, 104 Stat. 3935 (codified at 7 U.S.C. § 6501 (1999)). The Agricultural Marketing Service estimates that 11 state and 33 private organic certifying agencies provide organic certification to producers and handlers. *See* Program to assess Organic Certifying Agencies, 64 Fed. Reg. 30,861, 30,862 (1999). USDA has not yet adopted national standards. *See* note 40.

[42] There is nothing "paternalistic" about relying on scientific assessments of risk to determine whether mandatory labeling is appropriate. When scientific evidence indicates that important differences exist, labels alerting consumers to the difference, and reduce the costs for consumers of identifying the choice that best satisfies their preferences. Conversely, when the scientific consensus is that no meaningful difference exists, labels that highlight the difference at best can encourage consumers to search for information they likely will find irrelevant, and may lead consumers to make inferior choices in the mistaken belief that the difference is meaningful.

cost of information that is of no value to them. With voluntary labeling, for example, it is those who desire kosher products who must pay the costs of obtaining the necessary certification and providing the necessary labeling, not those who do not care whether the product is kosher or not. Similarly, to claim that a product is "organic," a producer must ensure that the raw agricultural commodity was produced in accordance with requirements for an organic product.[43] Costs of keeping "organic" produce separate from otherwise identical commodities are paid by consumers who benefit from the separation.

From an economic perspective, assigning the costs of information to those who benefit from it is efficient.[44] If the beneficiaries do not pay the full costs of their choices, they will have no incentive to take those costs into account. Instead, they will seek more of the benefit, and impose on other consumers costs that exceed the value of the benefit. This is the problem of externalities: if parties do not bear the costs of their actions, they choose so much of that action, and society wastes resources producing all of it.

Mandatory labeling of products that contain GMOs or GMO-derived ingredients essentially imposes all of the costs of labeling on those who do not think the information is relevant — those who are willing to continue to use products containing GMOs. The real beneficiaries of the information are those who care about GMOs, and will use the information to avoid products containing them. As long as others pay the costs, these beneficiaries naturally will "demand" more information than they are willing to pay for. If society subsidizes the informational preferences of an increasing number of groups, labels will grow in complexity, without benefits that the majority of consumers value and for which they are willing to pay.

Voluntary labeling also provides a continuing market test of whether consumers really care about the particular characteristic. Consumer survey evidence cannot predict whether they do; only actual behavior in the marketplace will determine whether consumers are willing to pay for a characteristic.[45] The world is littered with failed and forgotten products that incorporated some feature for which surveyed consumers were willing to pay. Such questions inevitably are hypothetical, and may not reflect actual behavior. For example, when rBST was introduced in the U.S. market, surveys indicated that consumers were concerned.[46] Based on those surveys, analysts predicted a four to twenty percent reduction in fluid milk consumption.[47] In fact, there were no detectable changes in fluid milk consumption. Although some producers labeled "rBST free" milk, the market share of such brands was only about one and a half percent.[48] Actual behavior did not reflect the hypothetical premarketing concerns.

Thus, voluntary labeling of products with features that consumers prefer is a market-mediated mechanism for determining whether information about the use of GMOs is valuable to consumers.[49] Consumer and market responses will reveal whether consumers value the difference in the production process, and the magnitude of any difference in value.

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[43] *See* sources listed, *supra* note 41.

[44] The allocation of costs may also be constitutionally significant in challenges to state labeling requirements under the Commerce Clause. *See* Burk, *supra* note 37, at 315.

[45] For a discussion of the limits of surveys in the context of valuing environmental benefits, see Peter A. Diamond & Jerry A. Hausman, *Contigent Valuation: Is Some Number Better Than No Number?* 8 J. ECON. PERSP. 45 (1994).

[46] Aldrich & Blisard, *supra* note 30, at 2.

[47] *Id*. at 3.

[48] *Id.*

[49] There is little basis for concern that markets will not reveal information because consumers do not know that a difference exists that might be relevant to them. When entrepreneurs identify a potential difference of value to consumers, it normally is the products with an advantage that first reveal the difference. Such producers have incentives to convey the information in the most effective way possible. Disclosure by the "best" products then generates pressure on other products to disclose as well, a phenomenon known as the unfolding principle. *See*

continued

C. *Direct Costs of Mandatory Labeling Programs*

1. *Separation Costs*

If products containing GMOs are to bear special labeling, whether voluntarily or by regulation, they must be identified first. This seemingly trivial requirement actually is a significant cost of any labeling scheme because differences between GMOs and their traditional counterparts frequently can be identified only by genetic analysis. Moreover, food ingredients produced using GMOs may be indistinguishable from the same ingredient produced by more conventional means. Thus, special labeling for GMO products requires separation of a particular product variety, whether genetically modified or "traditional," from other varieties.[50]

Throughout the agricultural processing sector, major agricultural products are treated as commodities. Although broad categories with substantially different properties (e.g., hard red spring wheat, soft white wheat, or durum wheat) are differentiated in the United States, grain otherwise is not identified by variety.[51] Instead, federal grain standards are the basis for the grain trade. These standards primarily rely on physical characteristics of the grain, rather than its composition. For example, broken kernels, foreign matter, and weight per bushel would affect grade, but moisture content and oil content would not.[52] Because growing conditions affect the composition of crops even from the same seeds, variability in composition is greatest at the farm and progressively narrows as grains from different sources are blended and they move through the distribution system.[53] Grain from different sources with differing characteristics is blended to achieve the particular properties, such as the ash content of flour or its water absorption properties, that a given end user may need.[54] Neither the grain standards nor the grain markets value compositional differences, except for the protein content of wheat and the oil content of sunflower seeds.[55]

Variations in grain quality based on product composition do exist and are valuable to particular users. The differences in value, however, are not sufficiently large to cover the cost of handling grain separately. Instead, buyers who need particular properties make their purchases based on chemical analysis of the different lots of grain available. Because only the average composition of the lot matters to the end user, there is no need to distinguish component grains in any more detail. Indeed, main-

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Paul Rubin, *The Economics of Regulating Deception*, 10 CATO J. 667 (1991). Empirical evidence in support of the unfolding principle is discussed in Pauline M. Ippolito & Alan D. Mathios, *The Regulation of Science Based Claims in Advertising*, 13 J. CONSUMER POL'Y 413 (1990).

[50] *See* Burk, *supra* note 37, at 232-33 (discussing the inability to detect differences between milk from cows treated with rBST and untreated cows). In other cases, processing may destroy evidence of differences in genetic origin. *See* Stewart & Johanson, *supra* note 10, at 283-85; *see also* Hadfield & Thomson, *supra* note 20, at 571 (noting the need for separation).

[51] Other countries differ in this regard. For example, Canada has a formal regulatory mechanism to determine which varieties can be grown, and distinguishes varieties based on visual characteristics of kernels throughout the distribution system. Similarly, in France marketing by variety also is common. Vera Krischik, *Comparison of Grain Marketing in Major Grain-Producing Countries*, *in* STORED PROD. MGMT, at 21-27, *available at*, <www.okstate.edu/OSU_Ag/agedcm4h/pearl/e912/index.html> (last visited Feb. 17, 2000).

[52] *See generally* Official United States Standards for Grain, 7 C.F.R. § 810.

[53] Even for a given grain variety, key characteristics such as protein content may vary considerably from farm to farm, depending on local growing conditions. *See* Bruce L. Dahl & William W. Wilson, *Consistency of Quality Characteristics in Hard Red Spring Wheats*, *in* AGRICULTURAL ECON. REP. NO. 393, at 63067 (May, 1998).

[54] Vera Krischik, David Shipman, & Richard Stuckey, *How Grain Moves Through the Marketing System*, *in* STORED PROD. MGMT, at 19, *available at* <www.okstate.edu/OSU_Ag/agedcm4h/pearl/3912/index.html> (last visited Feb. 18, 2000).

[55] *Id.*

taining separate product identity is not feasible economically in many instances. Niche products grown under identity preservation contracts must command price premiums of fifty cents per bushel or more to justify the costs of specialized handling.[56] With corn selling for just over two dollars per bushel, and soybeans selling for around $4.75 per bushel, the costs of specialized handling would represent a cost increase of ten to twenty-five percent.[57] Even with ascertainable differences in product characteristics for which some consumers may be willing to pay some premium, the value of the differences may be too small to justify the costs of separate handling for the majority of consumers in the market place. One study estimated that for these crops, naturally occurring variations in quality characteristics (e.g., protein composition, oil, starch, fiber, texture) that matter to end users are sufficient to justify price differentials of only ten to thirty cents per bushel.[58] Such a price premium may lead local elevators to keep the highest value grain separate, provided storage capacity is available.[59] Such segregation, however, is flexible. Adding some lower value (e.g., low protein) grain to the mix when capacity is scarce may reduce the quality differential, but it would not destroy it. In contrast, adding modern biotechnology crops to unmodified soybeans would defeat the whole purpose of separation.

In combination, the current structure of the grain handling system and the widespread use of some GM crops mean that as a practical matter, all products made from the grain are likely to contain GMOs or ingredients derived from GMOs.[60] Half of all U.S. soybean production is estimated to be from seeds modified to resist the herbicide Roundup.[61] As these beans move through the grain handling system and are blended with beans from other farms, an increasing fraction of soybean lots will contain GMOs. Required labeling of GM soybeans would amount to changing the name of the grain from "soybeans" to "genetically modified soybeans." Similarly, a quarter of U.S. corn acreage is modified genetically, either to resist herbicides or to resist insects.[62] Thus, most lots of corn likely include some modified corn as well.

For GMOs with quality traits, costs of separation are an important influence on the economic viability of the product. Unless the added quality trait is sufficiently valuable to cover the costs of specialized handling, such GMOs are unlikely to survive in the marketplace. High laurate canola will lose its distinguishing characteristic if it is mixed with canola from other sources, for example. Farmers will grow such crops only if buyers are willing to pay a sufficient premium for their unique characteristics. Separation is thus a minimal cost of labeling, because the whole rationale for such products requires separation in the first place.

For input traits, however, there is no premium included in the market price of a genetically modified product, because to the buyer the grain is no different than conven-

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[56] CHARLES R. HURBURGH, JR., CENTER FOR AGRICULTURAL AND RURAL DEVELOPMENT, IOWA STATE UNIVERSITY, INITIATION OF END-USER SPECIFIC GRAIN MARKETING AT IOWA ELEVATORS (1997).

[57] The *Wall Street Journal* reports cash prices for commodities daily. On February 17, 2000, corn was $2.055 per bushel (a year ago the price was $2.05 per bushel) and soybeans were $4.90 per bushel (a year ago the price was $4.72 per bushel). WALL ST. J., Feb. 18, 2000, at C18.

[58] HURBURGH, *supra* note 56, at 1.

[59] *Id.*

[60] The genetic endowment of virtually all modern crops has been altered through thousands of years of human selection, cross breeding, and, more recently, hybridization. As used in the text, "genetically modified" refers to modifications introduced through the use of modern biotechnology. *See* Rick Weiss, *Food War Claims its Casualties*, WASH. POST, Sept. 12, 1999, at A23.

[61] Rick Weiss, *Seeds of Discord: Monsanto's Gene Police Raise Alarm on Farmers' Rights, Rural Tradition*, WASH. POST, Feb. 3, 1999, at A1.

[62] *Id.*

tional varieties.[63] If the price differential is not sufficient to cover the costs of separation, farmers would have no incentive to use GMOs with input traits unless they reduce production costs by at least as much as the cost of the uncompensated special handling they would require.

One possible way to avoid the costs of separation is to allow labels that a product "may contain" GMOs. In the United States, however, such labeling would be ubiquitous, and therefore nearly useless. Absent separation, virtually all products containing soy or corn would have to be labeled. Such labels would not convey any product-specific information at all. At worst, a mandated GMO label would be deceptive, if its absence from products were to imply that the foods had not undergone genetic modifications at some point in their evolution.

2. *Information Costs*

Food labels fill an important role as a medium for providing consumers with information. They convey data about quantity, ingredients, nutritional composition, and the time and place of manufacture. Certain information of particular interest to consumers (e.g., fat free) may be highlighted in a prominent label location. In addition, labels convey information about brand, a crucial mechanism for ensuring product quality over time. In the store, where hundreds and thousands of products compete for consumers' attention, labels must serve another critical function — they must be effective signals. None of the benefits derived from information on the label will occur if consumers do not notice the product and consider its suitability for their purposes.

The amount of information that can be communicated is limited by the size of the label and the ability of consumers to absorb facts and consequences. The label cannot tell every consumer everything he or she might want to know about every product, because different consumers care about different things. Labels that contain too many messages may fail to deliver the most important ones. Although governments can require labels to include essential information of widespread utility, they cannot provide all of the information that might interest consumers. Moreover, attempts to do so can be counterproductive. The addition of more mandatory disclosures on food labels will make it increasingly difficult for consumers to locate the specific information that is important to them. If labels are too complex, consumers may miss essential information that is hidden in a fog of data that a regulator thought consumers had a "right to know."

Depending on its specificity, special labeling of GMOs could complicate product labels, even if disclosures are confined to the list of ingredients. In place of "corn and/or soybean oil," the consumer might find that the product contains "corn oil from plants genetically modified to resist insects and/or soybean oil from plants genetically modified to resist insects and pesticides and to reduce stearic acid content," along with "cheese manufactured using rennet from genetically modified microorganisms and milk from cows treated with bovine somatotropin from genetically modified microorganisms." Finding out that the product also contains peanuts may get more difficult for the allergic consumer, for example.

IV. CONCLUSION

The case has not been made for a mandatory scheme of special labeling for products that contain GMOs. Any such scheme would likely impose costs far in excess of

[63] If some buyers dislike GMOs for their own reasons, the market price of such crops would be less than the price of their "unmodified" relatives. For input traits, farmers would have no reason to plant such crops unless the productivity advantage more than offset the price disadvantage.

benefits. If there are benefits to particular individuals who wish to avoid GMOs or GMO-derived ingredients, producers have every incentive to cater to those preferences by providing information about the absence of GMOs voluntarily, just as producers have catered to markets among consumers interested in "natural" or "organic" products. Governments can, and should, worry about whether voluntary label claims that a product is "GMO free" are accurate. As with other voluntary claims, regulatory policies should seek to ensure that consumers get what they think they bargained for. The Federal Trade Commission's (FTC's) approach to deception and advertising substantiation has been successful in policing similar claims. For example, the FTC's guides concerning environmental advertising claims set forth a deception-based approach to "green" claims that easily could be extended to "GMO free" claims as well.[64]

Given the extensive genetic modifications that commercial foods have undergone, mandating distinctions between products based on the techniques used to introduce genetic change is minimally different from the attempts of medieval guilds to prevent the introduction of similar, and often better, products produced using machines instead of skilled craftsmen. In either case, techniques in use at a particular time are acceptable, but any subsequent changes are rejected, not because they result in materially different products, but because they are from too recent a vintage. If consumers value the traditional products, markets will provide them.

[64] Guides for the Use of Environmental Marketing Claims, 16 C.F.R. § 260. The principles behind the guides are discussed in J. HOWARD BEALES & TIMOTHY J. MURIS, STATE AND FEDERAL REGULATION OF NATIONAL ADVERTISING (1993).