

**GENETICALLY MODIFIED FOODS:
THE CREATION OF TRUST AND ACCESS TO GLOBAL MARKETS**

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ABSTRACT

For no modern industry is trust more critical – or more lacking – than for agricultural biotechnology. While bioengineering may transform agriculture in the fight against hunger, genetically modified foods are everywhere under assault. This paper argues that the key to rebuilding support for biotechnology lies with recognition of a new global framework uniting access to global markets with consumer and environmental protection, sensitivity to different international perspectives, and attention to reciprocity and trust

For no modern commercial industry is public trust is more critical – and more lacking – than for agricultural biotechnology. Researchers are on the threshold of using genetic engineering to usher in what the Rockefeller Foundation has called a “doubly green” revolution that modifies basic grains to make them more productive, more nutritious, and better suited to address the problems of world hunger and malnutrition. Yet, rather than inspire confidence, the industry with the ability to realize the fruits of these discoveries has sown the seeds of suspicion. The seed companies that dominate modern agribusiness – Monsanto, Dupont, Dow Chemical and Novartis – stand accused in the court of public opinion of indifference to public safety and consumer rights in the quest to dominate global agriculture. In a December 1999 landmark class action suit, Monsanto¹ and its “co-conspirators” stand accused in civil court of forcing genetically-modified (GM) seeds onto the domestic market at fixed prices without the adequate evaluation of potential risks to human health and the environment.² This anti-trust case unites the two halves of the growing distrust of agribusiness: the seed companies’ misuse of their aggregation of power over the food supply to impose their own terms on a global market, and farmer and consumer fear of the potential risk posed to the environment and human health by genetically altered crops. This combination of suspicion about industry intentions and uncertainty about safety has resulted in a European moratorium on GM seeds and foods and a domestic campaign to persuade food processors from Gerber’s to Campbell’s to forego GM products in their foods.³ Distrust of the industry has sparked a global collapse of consumer confidence in GM crops and foods.

Trust can be defined as the expectation that a business or an industry will act ethically, that is, that it will not promote its narrow self-interest at the expense of community norms or individual well-being. Trust is important not just to social relationships, but to the type of business dealings that form the core of market behavior. Frank Partnoy explains that:

Economists since Adam Smith have noted the value of reputational capital in sustaining a self-policing society. Individuals acquire reputations over time based on their behavior. If an individual's reputation improves, and other members of society begin to hold that individual in higher esteem, that individual acquires a stock of reputational capital, a reserve of good will, on which other parties rely in transacting with that individual. Reputational capital leads parties to include "trust" as a factor in their decision-making; trust enables parties to reduce the costs of reaching agreement.⁴

In earlier societies, reputational capital was a function of individual transactions and personal judgments. As society

became more complex, however, better functioning cultures developed institutions to inculcate trust. If business executives believe, for example, that their contracts will be honored, they conclude agreements more readily and take fewer precautions against breach. The result is that it is faster, easier and less expensive to negotiate agreements. Conversely, in societies where agreements are routinely breached without sanction, the parties are more likely to negotiate individual safeguards -- a process that often breeds further distrust, and fewer successful agreements.

The process of creating trust, however, is not simply one of building the right institutions. Francis Fukuyama observes that:

Law, contract, and economic rationality provide a necessary but not sufficient basis for both the stability and prosperity of postindustrial societies; they must as well be leavened with reciprocity, moral obligation, duty toward community, and trust, which are based on habit rather than rational calculation. The latter are not anachronisms in a modern society but rather the sine qua non of the latter's success.⁵

Trust achieves its greatest effectiveness when all of the parties to a transaction have internalized shared expectations about appropriate behavior. These expectations, which Fukuyama describes in terms of the habits of reciprocity, moral obligation and duty toward community, form the basis for an industry principles of ethical behavior. In the rapidly changing world of biotechnology, such a code, and the corresponding institutions that would inculcate the habits and expectations associated with it, do not yet exist. Indeed, for agricultural biotechnology, in particular, the absence of such shared understandings, as the Monsanto case demonstrates, has already bred distrust that may be difficult to overcome.

In this paper, we plan to discuss what it means to create trust, through a shared set of core values and ethical standards, within the context of agricultural biotechnology. In our use, ethical standards are those “standards by which a particular group or community decides to regulate its behavior—to distinguish what is legitimate or acceptable in pursuit of their aims from what is not.”⁶ Core ethical values are deeply held beliefs or desires that guide “legitimate” actions. Ethics seeks to clarify and analyze arguments concerning “legitimate behavior” and to probe the justifications provided for claims about right and wrong. It also provides a lens for examining the success of institutions in fostering appropriate habits, behaviors and goals.

We have chosen the field of biotechnology⁷ as a general venue for the discussion because the

developments within the field are so new, so rapidly occurring, and so potentially revolutionary that they already exceed the bounds of existing conventions and institutions. We take biotechnology to mean “. . . the application of biology for human purposes,”⁸ and human benefit. We see **the three main areas of biotechnology as food, drugs and medicine.** with **the distinctions among the three likely to blur as food becomes a way of delivering pharmaceuticals.** medicine relies more heavily on drugs, and innovation in all three areas proceeds to a greater degree from increasing knowledge about genetics and cellular biology.⁹

Within the field of biotechnology, we have chosen to concentrate on genetically modified foods (GMFs) because we believe that it is the arena in which trust will play the broadest role in future developments. We define agricultural biotechnology to include “. . . techniques that allow scientists to modify DNA, the genetic material of living things”¹⁰ in order to enhance food production. As such, it is not "new." In order to “improve” plant and animal products, selective breeding for particular genetic traits has been used for hundreds of years. What is revolutionary is that modern genetic technology enables scientists to move genes in ways that conventional breeding does not (e.g., between species) and to do so with greater speed and precision. Chemical and seed companies tried for decades, for example, to develop herbicide-tolerant crops through classic breeding techniques before Monsanto succeeded with genetically engineered Roundup Ready seed.

The success of agricultural biotechnology depends to a greater degree than other forms of biotechnology on trust because agricultural companies require access to mass markets for their success. A handful of infertile couples willing to spend a substantial portion of their savings can sustain a fertility clinic, offshore if necessary. Companies like Monsanto, in contrast, spend millions to develop seeds that sell for relatively small amounts per seed. Corporate success depends on their ability to persuade commercial farmers to buy large quantities of their product. Yet, large-scale farmers depend on access to export markets as much as on domestic consumption. **The future of GMFs, therefore, rests on international acceptance.** As **companies like Monsanto have gone from international powers to international pariahs,** consumer distrust has peaked in Europe, grown in the Americas, and driven genetically modified products from grocery shelves.

This paper will discuss the loss of consumer confidence in agricultural biotechnology, and the role of ethics

in restoring a measure of trust to the industry. In the process, we plan to avoid the extremes of the debate. Too much of the conversation about modern agricultural biotechnology involves either uncritical acceptance or uncritical condemnation of GM crops and foods. We will not repeat the arguments as to whether or not genetic modification and the creation of transgenic products is ever permissible. Instead, we will assume that **some use of genetic modification, if only for further research, is ethically permissible and, indeed, desirable.** We also reject, however, the arguments that because genetic modification is already in operation and difficult to ban altogether, that it is "inevitable" and therefore somehow beyond ethical consideration or restraint. Instead, we will argue that the most critical ethical issue surrounding genetic modification of agricultural products is not whether it should occur, but how. **The process of creating trust -- and of inculcating core values and ethical standards -- requires forming institutions that link decision-makers to those affected by their decisions,** and contribute to an ever changing, but renewable, consensus about the appropriate uses, marketing, and distribution of these products. As a result, we believe that full consideration of the ethics of this industry, and of the responsibility of business leaders within it, is not just about appropriate business decisions examined in isolation, but about the industry obligation to contribute to a more robust global framework for the resolution of these issues. Accordingly, this paper will, first, outline the coming "biotech century,"¹¹ and the role of agricultural innovations in the biological revolution that is upon us. Second, it will examine the nature of agribusiness, and the relationship between industry structure and distrust of genetic modification. Finally, it will discuss the need for a new global framework that unites concerns about trade and access to global markets with mechanisms to guard against unsafe products, unintended environmental effects, and the potential disruption of traditional agricultural practices that the new products may entail.

I. THE SCIENCE: THE PROMISES AND THREATS OF GENETICALLY MODIFIED FOODS

Genetic modification of plants and animals takes place in the context of an industry that has modified nature for human benefit for as long as agriculture itself has existed, and which can never fully assess the benefits and risks of the process until long after the fact. Prehistoric Native Americans, for example, began cultivating corn as a naturally occurring grass in Mexico, when the plant consisted of four rows of tiny kernels, less than an inch

long.¹² Using selective breeding and cross fertilization, the first Americans transformed the nature of corn over the course of a millennium that began a thousand years before Columbus.¹³ Modern scientists credit Native American farmers with almost all the critical genetic changes in the corn now on the dining room table, including increased size and nutritional value, color variation, larger, softer and more edible kernels, thinner husks, and better adaptation to regional growing conditions than the native plants.¹⁴

Agribusiness, even without the more recent techniques for genetic modification, accelerated the process the Native Americans began. Henry Wallace, Vice President under Franklin Roosevelt and founder of the Pioneer Seed Company, that today supplies 40% of American corn seed, produced some of the earliest commercial hybrid corn in the twenties and thirties. Wallace and Pioneer Seed deliberately crossbred corn varieties for high yield, uniformity, drought tolerance, and pest resistance.¹⁵

Direct genetic modification of corn-- splicing the DNA from one variety to another -- does not so much change the hybridization process as make it faster, and more precise. If Pioneer Seed executives wish to combine the best traits of a high yield corn variety with one that is more pest-resistant, all they need to do is to isolate and transfer the resistance conferring genes. It does not take several generations to get the right gene mix, and the process transfers only the variety's pest-resistant qualities without lowering yield.¹⁶

The more controversial step is the use of the same process to transfer genes from a different species. Pioneer, for example, has bioengineered corn to include a gene from wheat that is toxic to the European corn borer, a moth whose larvae cause 800 million dollars a year in damage to American corn.¹⁷ Monsanto has added to both corn and cotton a gene from a naturally occurring soil bacterium, *Bacillus thuringiensis* (Bt), that produces a toxic protein. Organic farmers use a biospray containing Bt protein as a "natural" way of controlling insects like the corn borer. However, sprayed Bt toxin becomes inactive within a few days. Since Bt corn produces a more powerful form of the toxin itself, the need for extensive spraying is eliminated. The genetically modified version becomes toxic immediately after the plant produces it, allowing it to affect a wider variety of insects.¹⁸

These uses of genetic modification, which have been the main focus of agricultural biotechnology to date, enhance production. The more revolutionary step, however, is the use of bioengineering to produce fundamentally different foods. Time Magazine, which devoted a major story to the issue, highlighted a new crop on the horizon --

rice bioengineered with two daffodil genes to contain the Vitamin A precursor, beta carotene.¹⁹ Health experts estimate that 124 million children worldwide are deficient in vitamin A, and that anywhere from 1 to 2 million children die each year because of inadequate nutrition, including a million who go blind in Southeast Asia alone because of the lack of Vitamin A.²⁰ Rice genetically modified to include Vitamin A could remedy the deficiency with no major changes in diet, culture, education or wealth.²¹

Bioengineering offers the promise, over time, of remaking not just the food supply, but medical practice and pharmaceuticals, ultimately uniting the different aspects of biotechnology into a single industry. It is possible to imagine a future in which:

- breakfast cereal supplies an entire day's nutritional and vitamin needs;
- corn contains all of the health advantages of broccoli, while retaining for days the taste that now peaks minutes after harvest;
- tomatoes deliver cancer fighting medications;
- rice and potatoes replace childhood vaccinations;
- ice cream resets the body's regulatory mechanisms to prevent obesity;
- and, all of the above custom tailor the chemicals, vitamins and nutrients they deliver to the individual needs they detect through sampling the blood stream after they enter the body.

If the biotech future offers such promise, why the concern? The most immediate response is that genetically modified foods amplify fear of known health hazards, and add the fear of the unknown. These fears can be divided into three categories. First is the fear that GMFs are not safe. U.S. regulators already monitor GMFs to safeguard against harmful effects on consumers, with particular attention to²²:

- **Toxicity.** Any food additive, particularly one chosen for its toxicity to pests, has the potential to harm humans as well.
- **Allergenicity.** Genes transferred from one plant to another may trigger allergic reactions not normally associated with the food to which they are added. If, for example, genes from peanuts were transferred to corn, corn might trigger the allergic reaction associated with peanuts to the potentially lethal surprise of the person eating the corn.

- **Pleiotropic effects (i.e., simultaneous effects on multiple characteristics of an organism).** If “golden rice” bioengineered to contain Vitamin A, for example, contains genes from daffodils, and genes from bacteria, the combined effect of the additions with the rice plants’ naturally occurring properties may be different from the effect of each gene acting in its natural setting.

Second is the concern for environmental devastation. U.S. regulators consider the possible environmental consequences of GM seeds and crops, specifically addressing²³:

- **The effects on non-target species.** The toxicant in Bt corn, for example, might harm not only the corn borer, its intended target, but other species with beneficial effects on the environment. While GMFs generally pose less of a threat to non-target species than indiscriminate use of pesticides, the potential (and unintended) threat to the Monarch butterfly,²⁴ for example, generated major public concern even though the publicized research was preliminary, and the existing studies inconclusive.²⁵
- **The effects of gene flows, particularly the unintended transfer of genetic information from cultivated crops to wild plants grown nearby.** Both conventionally bred and genetically modified plants that are resistant to herbicides might cross-pollinate with weeds, transferring the herbicide resistant qualities to the plants the herbicides are designed to kill.
- **The evolution of pest-resistance to pest-protected plants.** With time, all pesticides can be expected to contribute to the production of pesticide resistant insects. Genetic modification of multiple crops to include the same protein (e.g., Bt), particularly a protein that is also widely used in sprays, may increase the risk.²⁶

Scientists, industry executives, government regulators, and consumer activists largely agree in the identification of these concerns. Where they differ is in the assessment of the risks. Sheldon Krinsky explains that:

Recombinant DNA techniques are more accurate, or precise, than classical techniques for modifying organisms. Simply because scientists have higher levels of skill at creating technological applications for the fields of biology and agriculture does not mean that they necessarily have the insight to foretell, or predict the consequences of the technology The result is an unfounded leap from understanding genotypes [the genetic composition of an organism] to thinking we understand phenotypes [the visible properties of an organism] to believing we can predict ecological impacts.²⁷

Krinsky concludes that the true extent of the risk from GMFs is unknown, and given the state of existing testing, largely unknowable. He is particularly critical of the widespread use of substances such as a bovine growth

hormone, a naturally occurring hormone that increases milk production in cattle. He notes that since there is no evidence higher levels of the hormone cause any immediate adverse health consequences for milk consumers, existing law does not limit its use despite the absence of a thorough assessment of the possible secondary effects on humans, animals or the environment.²⁸ It would take a long term, large scale study, for example, to determine whether the hormone increases the risk of diabetes or breast cancer or has long term health consequences for the cows. While many researchers would join in Krinsky's call for more and better testing,²⁹ they are deep differences in the extent to which different groups would keep GMFs off the store shelves in the interim.³⁰

People also differ in the weight that they would attribute to the third category of concerns: the extent to which GMFs may contribute to a transformation in the structure of global agriculture. Castetous Juma, at a symposium on Transgenic Agriculture, prefaced his remarks by invoking the language of the United Nations Convention on Biodiversity (a widely adopted convention that the U.S. has not ratified):

The objectives of this Convention . . . are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefit arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding.³¹

The concerns of the Convention parallel the concerns associated with GMFs:

- **Biodiversity.** World agriculture already tends to promote single, uniform strains of popular crops that may either prove susceptible to a new disease or lack some of the as yet unrecognized advantages of the more diverse, older varieties. Will genetic modification increase reliance on single varieties, “perfect” for immediate growing conditions, but less able to adapt to future needs?³²
- **Sustainable use and the environment.** Bioengineering increases the availability of drought resistant and pest resistant crops better able to grow in adverse conditions. While the result may be more “sustainable” agriculture, it may also accelerate the use of marginal land for cultivation, with negative consequences for the soil or surrounding ecosystems.
- **Fair and equitable sharing and the prevention of “biopiracy.”³³** Intellectual property rights in biotechnological innovations such as Bt corn have been essential to the ability to attract funding for the

private research that has fueled the discoveries underlying GMFs. Overly broad intellectual property rights,³⁴ however, raise the specter that a few large companies will acquire monopolistic control over access to seeds, plants, or other biological products on which much of the world will come to depend.

- **Equitable decision-making about benefits and risks.** Large multinationals produce virtually all of the world's bioengineered products for use by first world farmers. Corresponding changes in farming practices may, intentionally or not, change the ways of life associated with traditional cultures. Monsanto's opponents, for example, have been appalled by its consideration of the use of infertile seeds, not only because it would increase farmers' dependence on a yearly resupply, but because it would undermine longstanding cultural practices tied to seed sharing and exchange.³⁵

Most of the concerns associated with genetically modified foods also apply to more conventional agricultural techniques. GMFs, however, combine greater publicity about risk with global skepticism about their production. The issue of trust is as much about the industry itself as about the product.

II. THE AGRIBUSINESS INDUSTRY: POWER OR PARIAH?

The popular attacks on genetically modified foods *are* attacks on the industry -- and to a lesser degree on global capitalism -- as much if not more than they are responses to the science of genetic modification per se. Agricultural biotechnology, after all, is big business. It is an industry characterized by a high degree of concentration, capital intensive and risky investments, and the need to compete in a global marketplace in which the idea of free trade in agricultural products is still highly contested. The production and marketing of genetically modified foods takes place within an industry that has been the subject of an on-going, long-term -- and long controversial -- transformation, marked by:

- **Consolidation and the decline of the small family farm.** Despite paeans continuing into the twenty-first century that celebrate the small family farm, it has been in retreat in the United States for over a century. While ninety-eight percent of the American public engaged in farming at the time of the American revolution, the number had fallen to twenty-five percent at the turn of the last century, and to less than two percent today.³⁶

- **The emergence of agriculture as capital intensive industry.** Agricultural productivity in the developed world has grown exponentially with mechanization, intensive fertilization, irrigation, and increasing reliance on selectively bred, high yield, drought and pest-resistant crops. The “Green Revolution” of the sixties and seventies, which led to a global increase of 3% per year in food crop production, resulted in primary part from higher yielding varieties of basic crops.³⁷
- **A greater supply of exports from the U.S. and from developed to developing nations.** U.S. agriculture, which once sought only to supply the immediate community, now feeds the world, with one in three U.S. farms growing food for export.³⁸ The traditional relationship between manufacturing and agriculture has been reversed with labor intensive manufacturing industries moving to lower priced developing countries while developed countries supply a higher percentage of world food products.³⁹ The United States is the world’s leading producer of agricultural commodities, supplying, for example, 40% of the world’s corn, 60% of its soybeans, and a sixth of the world cotton supply.⁴⁰ Industrialized countries generally supply 95% of dairy exports, 82% of cereals, 78% of meat, 70% of tobacco, and 61% of the fruits and vegetables produced for export.⁴¹

Corporate control and consolidation is characteristically “both upstream and downstream from farmers.”⁴²

On the input side, a small number of companies are assuming control of the seed production business, including Monsanto, Dupont, and Novartis (all major producers of genetically modified products).⁴³ On the output side, a recent merger in grain distribution, which has been tightly controlled by a handful of companies since the 19th century, will “result in a single firm that would control more than one-third of U.S. exports.”⁴⁴ Agricultural biotechnology takes place within this highly concentrated world.

It should therefore not be surprising that genetically modified products, once introduced by the major seeds companies, quickly dominated selected areas of agriculture. In the United States in 1998, for example, 25% of planted corn, 38% of soybeans, 45% of cotton, and 42% of canola were genetically modified.⁴⁵ Moreover, with the U.S. producing 60% of the world’s soybeans, and 60% of processed foods containing soy products, a major part of the entire world supply of processed goods may soon be genetically altered and 70% of the American total already

is.⁴⁶ Stewart and Johanson speculate that, if the European Union insists on labeling laws, it might ironically contribute to greater acceptance as most processed foods might be required to state that they “may contain” genetically modified products.⁴⁷

Attitudes toward agribusiness frame the debate about bioengineered foods. For the industry itself, genetic modification offers a continuation of the advances achieved through a scientific approach to farming, and a solution for the problems of more conventional agriculture. From 1950 to 1984, the world food supply increased by 260% in large part because of the better research that produced more productive plant varieties and agricultural techniques. Per capita food production dropped in the early nineties for the first time since WWII.⁴⁸ GMFs promise to jump start increases in food supply through a better application of the principles underlying the “Green Revolution,” *viz.*, scientific research producing more nutritious, higher yielding plants and animals. At the same time, genetic modification is expected to do so in ways that improve the environment: pest-resistant plants require application of fewer fertilizers, drought-resistant plants require less irrigation. The new techniques may also increase biodiversity by recombining genes from different species, and making it easier to transfer desirable qualities from wild strains to established plants. To the extent that the new products constitute a threat to traditional farming practices, it is because they offer more efficient agricultural methods that farmers choose to adopt. If the foods prove unsafe, regulators in the U.S. and Europe stand ready to prevent the offending products from reaching grocery shelves, and if, as critics claim, the new products fail to deliver the promised benefits,⁴⁹ the market will take care of the problem.

Opponents of genetic modification object most fundamentally to the business as usual approach of the agribusiness industry, and their distrust of the existing industry amplifies their objections to the new techniques.

The language of the protestors is often the language of politics, rather than science. Brewster Kneen, for example, writes in his book, Farmageddon:

If five or six giant corporations have control over every seed of all major commercial crops planted anywhere on the earth, that is totalitarian. Add to seeds control over the genetics of all major lines of commercial animals and it will be somewhat more totalitarian. Then engineer all the genetics -- plant and animal -- to be hybrids, sterile, or both, and the achievement will be without question totalitarian. It will amount to the occupation of the land -- the earth itself -- by foreign troops and their local mercenaries. . . . We should not be fooled into believing that the intent of engineering the seed and occupying the land is to feed the world or save the environment; it is to gain control and create dependency. Like all imperial and colonial endeavors, its purpose is to gain the ability to exploit the resources of the colonized

area and people for the benefit of the imperial powers. The new twist is that the imperial powers are now corporations, not states.⁵⁰

Kneen then calls for an attack on genetically engineered products, encouraging labeling, consumer boycotts, and organized pressure on supermarkets and manufactures (e.g., Campbell's) to remove the products from the market.⁵¹

Kneen's critique, though written in more hyperbolic language than some, echoes the major themes of agriculture biotechnology's critics:

- the field is subject to the domination of a few large companies;
- the companies act in their own self-interest;
- the companies act outside of national boundaries and outside of effective democratic control;
- the promised benefits are illusory either because they are unnecessary (e.g., organic techniques could accomplish the same results with less risk) or because they will be ineffective (the real problem with world food supply is not lack of food, but poverty, inequality and inadequate distribution);
- the companies reap the benefits of the new techniques while the rest of the world bears the risks.⁵²

This critique unites resentment of multinationals generally with the specific concerns about GMF safety, and it combines opposition to the dominance of the market with celebration of the more natural world of organic farming and traditional cultural practices. Its ultimate point, however, rests on the relationship between risk and trust: We know that the agribusiness companies are acting in their own narrow self-interest, so why should we trust them with anything so fundamental as the reconstruction of the genetic code?

III. THE ETHICAL CHALLENGE: RECONSTRUCTING TRUST

Genetic modification that produces corn with bacterial toxins, and rice with the beta carotene of daffodils *does* conjure up images of Frankenstein. Moreover, the critics are correct that the full range of risks associated with the process is unknown, and unknowable. It is nonetheless also true that we can assess the very real benefits from more productive, nutritious and cheaper plants, and that we accept levels of risk at least as high from other forms of technological innovation, including conventional agricultural techniques. The issue of trust is at the core of resolving the question of whether -- and on what terms -- to proceed. It is easier to accept a measure of risk in the presence of trust.

In considering the possibilities for creating trust, it is useful to acknowledge that there is, of course, nothing

unprecedented about distrust of big business, suspicion of new technologies, or concern about food safety and environmental contamination. Indeed, there is a very apt precedent – that is, the reform of the food industry at the turn of the last century. This example, like the one at hand, combines a technological revolution with new methods of food production, distrust of big business, and a crisis in consumer confidence.

The technological revolution at the beginning of the twentieth century was the industrial one. The Industrial Revolution transformed transportation (from horses to trains and later cars and planes), communication (from hand carried messages to telegraphs to radio transmissions and telephones), manufacturing (from crafts to factories, from individual products to mass production), and food production. Better transportation and refrigeration made it possible to ship foods long distances. More critically, chemical additives prolonged shelf life -- and disguised decay. Where consumers once relied on physical inspection and their grocers' personal reputation to insure food safety, the changing nature of food production rendered the former unreliable and the latter irrelevant. Upton Sinclair's book, The Jungle, which describes in sickening detail the abuses of Chicago meat packing plants, is perhaps the single most effective example of muck-raking journalism in the twentieth century, and it sparked a crisis in confidence in the food industry.⁵³

Two types of responses restored public trust. First, the Progressive Era invented big government to counter the growing power of big business, and to provide the type of expertise individual consumers lacked.⁵⁴ The Food and Drug Administration (FDA), established in 1906 (30 years before the New Deal), was the first of the modern regulatory agencies to take on direct business oversight. The classic conservative critique of the agency is that it is glacially slow and risk adverse. Its reputation is hurt more by approval of a single drug or food item that proves to be dangerous than by the bureaucratic delay or disapproval of thousands of useful products.⁵⁵ Second, the market, together with government regulatory agencies or separately, devised mechanisms for assessing reliability. Brand names (Johnson & Johnson, Campbell's Soup, Coca-Cola) provided quality assurance. So did private independent rating agencies (the Good Housekeeping Seal of Approval, *Consumer Reports*). Labels on cuts of beef and, more recently, on organic products and the listing of processed food content on the package provided additional consumer guidance.

Both the government and the private responses helped establish industry norms. It would be illegal, unethical and a breach of public trust to circumvent the FDA approval process to flood the market with questionable food or drugs. Indeed, U.S. agribusiness, subject to a voluntary consulting process with respect to genetically modified foods in the U.S. market, has uniformly invoked the review process before proceeding with new GMFs, and the U.S. public has a higher level of confidence in these products than do foreign consumers.

These measures worked for a number of reasons. First, they gave consumers reason to believe that the institutions guaranteeing food safety in fact represented their interests. The FDA's reputation for bureaucratic delay, if that delay promoted food safety at the expense of industry cost and convenience, contributed to consumer confidence. Second, they gave consumers reason to believe that the food industry, acting in accordance with formal constraints (FDA regulation) and internalized industry norms, would provide safe foods. It is important in this respect for consumers to have reason to believe that companies like Sara Lee, acting to advance its own standards and carefully nurtured reputation, would provide a product of uniform quality. Third, brand names, nutritional labels, and cuts of meat all gave consumers a way to judge products with a measure of reliability.

Finally, underlying all of the rest, is a process for reaching consensus on the framework to be used in judging food safety and quality. Organic foods provide a case in point. Consumers cannot determine from physical inspection whether a particular plant is organically grown, nor do they necessarily agree among themselves which substances count as inorganic chemicals and which do not. The growth of the industry therefore depended, initially, on private organizations providing organic standards and certifications, and more recently on a federal law contributing to the standardization of the process across state lines.⁵⁶ Without confidence that a given product conforms to an established definition of organic, and a corresponding value commitment on the part of its producers, there is no reason to pay the higher prices ordinarily associated with organic labels.

Do these lessons translate into a program for restoring confidence in genetically modified foods? Not automatically, for a key lesson in the Progressive Era experience was the need to address not just the issue of food safety, but the changing structure and reputation of the industry. Today's biotech innovations, which are at least as far reaching as the last century's industrial advances, take place in the context of a revolution in information

technology characterized by decentralization, globalization, and growing faith in the power of free markets and liberal democracies. The biotech companies *are* playing by the existing rules, and to a large degree they are acting in accordance with the values of the American marketplace, and American agriculture. The problem is that these values are not necessarily global ones, and they do not necessarily give foreign consumers reason to have confidence in either American regulators or business executives.

This difference in perspective is illustrated by a comparison between two reports: Genetically Modified Pest-Protected Plants: Science and Regulation (American Report), prepared by the National Research Council, and Transgenic Plants and World Agriculture (International Report), prepared by members of the Academies of Sciences of the United States, Brazil, China, India, Mexico, the Royal Society of London, and the Third World Academy of Science. Both reports were issued in response to the growing international concern about GMFs, and both address the health and safety issues, the need for regulatory oversight, and the issue of public acceptance. Neither gives credence to claims that genetic modification is “unnatural,” intrinsically harmful, or unnecessary. Nonetheless, the American report expressly excludes philosophical and social issues from consideration, focusing only on science and regulation, while the International Report views the larger social context as an integral part of the future development of transgenic products.

Both reports begin by acknowledging the promise of transgenic plants, and their critical role in global food security. The U.S. report then treats the central issue as a scientific one: how to evaluate the potential risks to food safety and the environment, and design an appropriate regulatory structure to assess and monitor the risks. The report begins by reaffirming the three central tenets of the U.S. regulatory approach:

- . . . There is no evidence that unique hazards exist either in the use of rDNA [recombinant DNA] techniques or in the movement of genes between unrelated organisms.
- . . . The risks associated with the introduction of rDNA-engineered organisms are the same in kind as those associated with the introduction of unmodified organisms and organisms modified by other methods.
- . . . Assessment of the risks of introducing rDNA-engineered organisms into the environment into which it is introduced, not on the method by which it was produced.⁵⁷

The National Research Council committee then examines the health and environmental risks discussed above, and recommends more extensive research and testing, and a better integrated agency framework for review. It

concludes:

In general, the current US coordinated framework has been operating effectively for over a decade. However, the committee has identified several kinds of improvements that would be helpful in the face of a larger number of commercialized transgenic pest-protected plants and novel gene products introduced into these plants. Those improvements might be necessary for increased confidence in US agricultural biotechnology both domestically and worldwide.⁵⁸

The International Report, while it also addresses regulatory and safety issues, is far more fundamentally concerned with the potential uses of transgenic products, and the equitable allocation of the risks and benefits. The Report's central finding is:

... that steps must be taken to meet the urgent need for sustainable practices in world agriculture if the demands of an expanding world population are to be met without destroying the environment or natural resource base. In particular, GM technology, coupled with important developments in other areas, should be used to increase the production of main food staples, improve the efficiency of production, reduce the environmental impact of agriculture, and provide access to food for small-scale farmers.⁵⁹

The International Report then recommends the following: increased public sector funding to bring the benefits of GM technology to all the world's people; greater investment in the oversight procedures necessary to insure biosafety; limitations on intellectual property claims that would restrict the use of GM technology in the developing world; where appropriate, seed reuse by farmers; and the formation of public-private partnerships should be encouraged to facilitate use of transgenic products to feed the poor.

Contrasting with both of these studies is a British Medical Association (BMA) report, dated May 18, 1999.

The BMA's 19 recommendations include issues of major concern to Europeans such as suggesting that:

- there should be an open-ended moratorium on the commercial planting of GM crops, until there is a scientific consensus on safety;
- GM organisms should not be released into the environment until the level of scientific certainty makes this acceptable;
- GM foodstuffs should be segregated at the source to ensure traceability and the Food Standards Agency should consider banning mixed GM and non-GM products or insist that they are clearly labelled.⁶⁰

The European Union has since effectively blocked importation of GMFs.⁶¹

It is easy to characterize these positions as expressions of self-interest. The United States is far ahead of the rest of the world in the use of genetic modification, and has the most to gain from relatively unrestricted trade of transgenic products. In the developing world, grain is a higher percentage of the overall diet, and population pressures make an expanded food supply more critical. European interests are more closely aligned with risk

adverse consumers. On the one hand, European agricultural interests, which have been much slower to adopt the new techniques, would be hurt by the greater competition with U.S. producers, and on the other, the European public is more concerned about safety than about high prices or food availability. [Let them eat brie!]

Nonetheless, the failure of agribusiness interests to recognize the needs of a global marketplace has been a major ethical failing of the industry, and a public relations disaster. This insensitivity has at least three components:

- Monsanto's effort to defend the use of infertile seeds. Monsanto has been the most publically visible industry leader, and its explanations of the need to control use of the new technologies have almost been entirely phrased in terms of its own needs, concerns about profit, and the structure of the market.
- Promotion of U.S. trade interests. International debate over biosafety has most consistently taken place in the context of trade relations. The U.S. has engaged in a highly publicized fight to overturn French refusal to import beef given bovine growth hormone, and it has opposed European efforts to impose a moratorium on GMFs, and to require labeling. It also engaged in a major lobbying campaign against international bio-safety protocols.
- Arrogance. U.S. regulators resolved the issue of food and environmental safety in favor of marketing these products almost a decade ago, and identify the more cautious European approach with scientific ignorance, or European protectionism toward its own farmers.⁶²

The net result of these differences in perspective, and the failure of American companies to acknowledge them, has been industry actions that reinforce the fears and distrust of those opposed to GMFs, *viz.*, that they are the products of a monopolistic industry more concerned with expansion and profit than the needs of others. In this context, Progressive Era reforms have no immediate application. There is no reason for foreign consumers to trust U.S. regulatory agencies, no international bodies with real regulatory power exist, and the U.S. has opposed the most influential of the international protocols. Nor can the food industry resolve the issue entirely on its own. The food manufacturers who do have a reputation for concern about quality are end producers like Campbell's or Sara Lee, and they could assuage public concerns only by refusing to use GMF products in their foods. The seed companies like Monsanto, who are most directly responsible for the development, testing and marketing of GMFs, have been relatively anonymous in the past, and are being defined today by the arrogance they have displayed in this debate. For better or ill, the future of the new technologies may rest on the reputation of the industry creating them.

In this context, is there a way to restore consumer trust? If so, it is by returning to the larger conception of core values and ethical behavior that we cited at the beginning of this paper, a conception built on reciprocity, moral obligation, and duty toward community. The most striking difference between the International Report, and the American and British ones is that it chose the broadest perspective, the one that defined “community” in global terms and examined the benefits and risks of genetic modification, not just in terms of the opportunities most likely to be exploited, but in terms of the world’s most pressing needs. If the industry were to adopt this conception of community, and a corresponding duty toward that community, it would consider supporting research and the development of products more directly targeted at the concerns of the developing world. Time Magazine’s article, “Grains of Hope,” describes the invention of golden rice by a University researcher seeking to alleviate world malnutrition as “the first compelling example” of a genetically engineered crop that may benefit not just the farmers who grow it but also the consumers who eat it.⁶³ Such research, and a corresponding commitment to use the research to benefit those most in need, must be an integral part of the *industry* commitment to a biotech future and to participation in a global community.

In similar terms, the commitment to safety should be a matter of moral obligation, and not just regulatory compliance. Regal argues that a major part of the European disenchantment with genetic modification comes from the industry’s disingenuous dismissal of safety concerns, and its misleading descriptions of the underlying scientific studies. He argues that the more accurate case for the industry position is that “it would be very difficult and highly expensive to offer high-quality scientific assurances about biosafety,” and that a number of the assurances demanded by proposed international protocols are simply impossible to provide, however safe the product.⁶⁴ Regal concludes that it would engender greater public confidence if the industry simply admitted that there can never be absolute assurance of safety, and then engaged in a constructive effort to devise reasonable levels of testing. A commitment to safety is a matter of habit and moral obligation. Honest appraisal of risk and the limits of knowing are essential components of trust in the global marketplace.

Finally, the idea of reciprocity requires support for creating the institutions necessary to safeguard the public, as well as industry interests, in biotechnology. The industry and its American representatives have attempted to use free trade principles to compel other countries to accept American agricultural products. The reciprocal obligation is the creation of international standards for determining their safety and use. In similar terms, the

industry may be right that intellectual property rights are essential to its development and success. The reciprocal obligation is to insure that enforcement of such rights does not prevent realization of the benefits of the subsequent developments in developing countries.

Trust as a core value is essential to effective business and marketing practice in a global economy . Trust, in this sense, is the confident belief in and the reliance on the habits and characters of corporations. Concern for reciprocity, safety and the global community can reseed consumer confidence in agribusiness and biotechnology. Today, the devastating symbol of biotechnological development is the "Terminator Seed," designed to render genetically modified seeds infertile to insure industry control and profit. The symbol of tomorrow should be a "doubly green revolution" identified with a trust-driven public/private partnership committed to realizing the promise of a biotech century for the benefit of a global community.⁶⁵

ENDNOTES

¹ Although only one of many "life science companies," Monsanto has become synonymous with transnational agribusiness. Monsanto holds the patents on the two most significant genetically-modified crop technologies, the Bt gene ("Yieldgard"), which causes plants to produce their own pesticide, and the glyphosate-resistant gene, which produces seeds that are resistant to the Monsanto herbicide Roundup ("Roundup Ready").

² Pickett, Higginbotham, C-K Farms, Naylor, Naylor, de Kochko v. Monsanto filed in the United States District Court for the District of Columbia, December 14, 1999.

³ Gerber has banned GM ingredients from its baby food. It is interesting to note that Novartis, the parent of Gerber, is one of the leading producers of GM seeds. See David Barboza, "Modified Foods Put Companies in a Quandry," New York Times, www.nytimes.com/library/national/science/health/060400food-quandry-health.html, (June 3, 2000).

⁴ Frank Partnoy, "The Siskel and Ebert of Financial Markets?: Two Thumbs Down for the Credit Rating Agencies," 77 Wash. U. L. Q. 619 (1999).

⁵ Francis Fukuyama, *Trust: The Social Virtues and the Creation of Prosperity*, 11 (New York: The Free Press, 1995).

⁶ A. Flew (ed.), *A Dictionary of Philosophy*. (London: Pan, 1979), 104-5. Quoted in Michael J. Reiss and Roger Straughan, *Improving Nature? The Science and Ethics of Genetic Engineering*. (New York: Cambridge University Press, 1996), 46.

⁷ Biotechnology, a broad term, is the "utilization of biologically derived molecules, structures, cells, or organisms to carry out a specific process." More specifically, biotechnology often refers to particular technologies such as recombinant DNA or cell fusion. These technologies have commercial applications in various fields, including the development of human therapies, animal husbandry, agriculture, food production and environmental management. Peter B. Hutt & Richard A. Merrill, *Food and Drug Law* 971 (1991).

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- ⁸. Reiss and Straughan, supra at 2.
- ⁹. See Juan Enriquez and Ray A. Goldberg, “Transforming Life, Transforming Business: The Life Science Revolution,” *Harvard Business Review*, Reprint R00203: 96-104, (March-April 2000). See also Andrew Pollack, “Ventures Aim to Put Farms in Pharmaceutical Vanguard,” *New York Times*, Section A, p. 1 (May 14, 2000).
- ¹⁰. FDA Backgrounder, “Biotechnology of Food,” vm.cfsan.fda.gov/~lrd/biotechn.html, (1994).
- ¹¹. Jeremy Rifkin, *The Biotech Century: Harnessing the Gene and Remaking the World* (New York: Penguin Putnam, 1998).
- ¹². Robert E. Rhoades, “The Golden Grain: Corn,” *National Geographic*, 183: 94-117, June 1993.
- ¹³. Rhoades dates the first corn cultivation at 1500 B.C. Lienhard more conservatively estimates it at 200 A.D., and argues that corn did not become a staple of American agriculture until the time of Charlemagne, observing that: “Grain farming isn't simple. It took six centuries to invent the technology of farming corn.” John H. Lienhard, *Origins of American Agriculture*, <http://www.uh.edu/admin/engines/epi571.htm>.
- ¹⁴. Rhoades, supra at 110.
- ¹⁵. Id.
- ¹⁶. For a thorough discussion of pest-resistant plants, see *Genetically Modified Pest-Protected Plants: Science and Regulation*, Committee on Genetically Modified Pest-Protected Plants, Board on Agriculture and Natural Resources, National Research Council, Washington, D.C.: National Academy Press, 2000.
- ¹⁷. Rhoades, supra at 110.
- ¹⁸. Rifkin, supra at 84.
- ¹⁹. J. Madeline Nash, “Science: Grains of Hope,” *Time Magazine*, July 31, 2000.
- ²⁰. “New Rice Could Save Lives: Scientists Create Golden Rice With More Vitamin A,” <http://www.abcnews.go.com/sections/science/DailyNews/rice000113.html> (January 13, 2000).
- ²¹. Researchers spliced three genes -- two from daffodils and one from a bacterium -- to rice to produce a grain that contains beta carotene, a plant compound that the body converts to vitamin A. The scientists also added a gene from a bean to increase iron content, and further modified the rice to make easier for the body to absorb the iron. *Tufts Nutrition Commentator*, http://commentator.tufts.edu/archive/food_bio/rice.html (August 3, 1999).
- ²². *Genetically Modified Pest-Protected Plants: Science and Regulation* supra at 7.
- ²³. Id. at 9.
- ²⁴. John E. Losey, Linda s, Raynor, Maureen E. Carter, “Transgenic Pollen Harms Monarch Larvae,” *Nature* 399: 214 (1999).
- ²⁵. See, for example, C. L. Wraight, A. R. Zangerl, M.J. Carroll, M.R. Berenbaum, “Absence of Toxicity of *Bacillus thuringiensis* Pollen to black Swallowtails under Field Conditions,” *Proceedings of the National Academy of Sciences* 97: 7700-7703 (2000) and David S. Pimentel, Peter H. Raven, “Bt Corn Pollen Impacts on Nontarget

Lepidoptera: Assessment of Effects in Nature,” Proceedings of the National Academy of Sciences 97: 8198-8199 (2000).

²⁶ Jeremy Rifkin argues that field tests of Bt cotton killed approximately 80% of the targeted cotton bollworms, exactly the fatality level researchers use when they are trying to breed resistant insects. Rifkin, at 85. What Rifkin doesn't mention is that Bt cotton is intended to be used with other pest control procedures to control the other 20%, and that federal regulators monitor compliance with the procedures. Eric S. Grace, *Biotechnology Unzipped: Promises and Realities* 110-111 (Washington, D.C.: William Henry Press, 1997).

²⁷ “Symposium: Transgenic Agriculture: Biosafety and International Trade,” 4 B. U. J. Sci. & Tech. L. 4 (1997), notes 50-54 and accompanying text.

²⁸ Id. at notes 60-63, and accompanying text.

²⁹ The National Research Council Report, *Genetically Modified Pest-Protected Plants*, for example, both underscores its support for continuing to treat GMF and conventionally bred plants in the same way, and calls for more and better testing of the some of the issues that concern Krinsky.

³⁰ Krinsky, for example, cites the response of a woman who is a member of the National Institute for Environmental Health Sciences. Asking whether she would drink milk produced with bovine growth hormones, she emphatically answered “No,” not on the basis of any hard data, but rather because of her “visceral feeling about the current state of events, which does not give individuals an opportunity to choose whether to accept exposure to unknown risks.” See “Symposium,” supra, at note 81 and accompanying text.

³¹ “Symposium,” supra, at 31 and accompanying text, cites the Convention on Biological Diversity, opened for signature June 5, 1992, arts. 28-29 I.L.M. at 834-35.

³² For a summary of this argument, see Rifkin, supra at 110-12.

³³ This is an ideologically loaded term that equates patents and intellectual property rights with the European theft of New World land from its native inhabitants. See, e.g., Vandana Shiva, *Biopiracy: The Plunder of Nature and Knowledge* 1-2 (Boston: South End Press, 1997). It is most classically used to describe biotech company patents on products taken from plants in the developing world. Rifkin, e.g., describes the W.R. Grace Company's patenting of the production of extracts from the neem tree, an Indian native known for centuries for its healing qualities. Supra, at 50.

³⁴ The term “overly broad intellectual property rights,” which is not defined, comes from the report, *Transgenic Plants and World Agriculture*. This Report was prepared under the auspices of the Royal Society of London, the U.S. National Academy of Sciences, the Chinese Academy of Sciences, the Indian National Science Academy, and the Mexican Academy of Sciences and the Third World Academy of Sciences and published by The National Academy Press in July 2000.

³⁵ See, e.g., Brewster Keen, *Farmageddon: Food and the Culture of Biotechnology* 177-78 (Gabriola Island, Canada: New Society Publishers, 1999). See also *Transgenic Plants and World Agriculture*, supra, commenting on the spiritual significance of grain production in Africa, Asia, and some of the Americas, and farmers' insistence on the right to decide whether to reuse seed. These commentators fail to note, however, that more conventional breeding techniques, such as the use of hybrid lines, also produce corn whose seeds lack the same qualities as the original, requiring new seed each year to maintain the same level of production. See, e.g., Encarta '95, Corn. Because the farmers can “choose” to replant the inferior seed, and because decision-making about hybrid corn does not receive the same level of public scrutiny, the quality of hybrid seed is not part of the public debate.

³⁶ Harbur, id. at 385; Neil D. Hamilton, “Symposium: Changing Structures and Expectations in Agriculture: Agriculture Without Farmers? Is Industrialization Restructuring American Food Production and Threatening the Future of Sustainable Agriculture?” 14 N. Ill. U. L. Rev. 613, 615 (1994). In the rest of the world, there has also

been a long term decline in the percentage of the population engaged in agriculture corresponding to the country's level of development. Nonetheless, in the early nineties, half of the population of Africa, 61% of Asians, and 24% of South Americans were still engaged in agriculture. Encarta '95.

³⁷. *Transgenic Plants and World Agriculture*. See also Eric S. Grace, *Biotechnology Unzipped: Promises and Realities* 110-111 (Washington, D.C.: William Henry Press, 1997).

³⁸. Hamilton, at 622.

³⁹. Ambassador Peter Scher, "The WTO and America's Agricultural Trade Agenda," 9 Minn. J. Global Trade 1(2000).

⁴⁰. Encarta '95.

⁴¹. *Biotechnology, Agriculture and Food*, Report of the Organization of Economic Cooperation and Development, 185, Paris, France, 1992.

⁴². Robert Scott, "Exported to Death: The Failure of Agricultural Deregulation," 9 Minn. J. Global Trade 87, 91 (2000).

⁴³. *Id.* at 91-92. See also Luke Anderson, *Genetic Engineering, Food, and our Environment*, 87 (White River Junction, Vt: Chelsea Green Publishing Company, 1999) (estimating that 40% of U.S. seeds come from a single source, and that the top five vegetable seed companies control 75% of the global vegetable seed market).

⁴⁴. *Id.* at 91-92. Anderson, *supra* at 87, described the acquirer, Cargill, as the world's largest grain exporter, and maintained that the merger would allow it to control 45% of the global grain trade. There has also been increasing vertical integration of U.S. agriculture, with corporate seed and grain distribution companies more likely to control farming as well. See, e.g., Hamilton, *supra*.

⁴⁵. *Food Biotechnology in the United States: Science, Regulation, and Issues*, Congressional Research Service Report to Congress, June 2, 1999.

⁴⁶. *Time*, *supra* at 42.

⁴⁷. Terence P. Stewart and David S. Johanson, Policy in Flux: The European Union's Laws on Agricultural Biotechnology and Their Effects on International Trade, 4 Drake J. of Agricultural L. 243, 295 (1999).

⁴⁸. Grace, *supra*, at 110-11.

⁴⁹. Biotechnology's critics have trumpeted its failures. See, e.g., Rifkin, *supra* at 84-85.

⁵⁰. Brewster Kneen, *Farmageddon: Food and the Culture of Biotechnology* 179-80. Cf. Vandana Shiva, *Biopiracy: The Plunder of Nature and Knowledge* 2 (Boston: South End Press, 1997). (The duty to incorporate savages into Christianity has been replaced by the duty to incorporate local and national economies into the global marketplace, and to incorporate non-Western systems of knowledge into the reductionism of commercialized Western science and technology.)

⁵¹. *Id.* at 190.

⁵². Using even more political language than Kneen, Vandana Shiva concludes: "IPRs [intellectual property rights] on crop varieties that are creating ecological havoc is an unjust system of total privatization of benefits and total socialization of costs. Monopolies linked to this unaccountable and unjust system prevent the development of

ecologically sound and socially just practices. Further, they force an agricultural system on people that threatens the environment and human health.” Shiva, supra, at 37.

⁵³. Upton Sinclair, *The Jungle* (New York: Doubleday, 1906).

⁵⁴. See, e.g., Herbert Croly, *The Promise of American Life* (Cambridge: Belknap Press, 1965).

⁵⁵. The other classic critique is that, like most regulatory agencies, it has been subject to industry capture. Both may be true. Whether industry executives realize or not, it may be in the food industry’s long term self-interest to be regulated by an agency whose perceived first priority is consumer safety.

⁵⁶. See Timothy J. Sullivan, “Implementation of National and International Organic Certification and Labeling Standards,” 7 S.J. Agri. L. Rev. 43 (1997).

⁵⁷. *Genetically Modified Pest-Protected Plants: Science and Regulation*, supra, at 6. rDNA refers to recombinant DNA, defined as “molecules developed outside living cells by incorporating DNA fragments in DNA that can replicate in a living cell”. Guidelines for Recombinant DNA Research, 59 Fed. Reg. 34,496-97 (1994). Genetic engineering involves use of rDNA to transfer genes from one organism to another.

⁵⁸. Id. at 18-19.

⁵⁹. *Transgenic Plants and World Agriculture* at 6.

⁶⁰. British Medical Association Report, “The Impact of Genetic Modification on Agriculture, Food and Health,” quoted in BMA Statement on Genetically Modified Organisms, <http://web.bma.org.uk/pressrel.nsf/533c004523364a8e8025679f004e6ade/0e7ff8033d37193380256774004c6933?OpenDocument> (May 18, 1999).

⁶¹. See, *Time*, supra at 44.

⁶². For a more detailed discussion of these issues, see Phil Regal, *The European Furor over Genetically Engineered Foods: Why?* <http://www.cbs.umn.edu/~pregal/Europeans.htm> (July 1999).

⁶³. *Time*, supra, at 41.

⁶⁴. Regal, supra, at <http://www.cbs.umn.edu/~pregal/Europeans.htm>.

⁶⁵. *Time*, supra, at 46.