

LABEL IT NOW



What You Need to Know About Genetically Engineered Foods

Gary Hirshberg, Charles Benbrook, and Britt Lundgren





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“Genetically Modified Organisms (GMO): Plants or animals that have had their genetic makeup altered to exhibit traits that are not naturally theirs.”

- From the Glossary on the Monsanto Web site¹

Introduction

I am Gary Hirshberg, and I have spent the last 35 years - more than 60 percent of my life - studying and advocating for more ecological and sustainable ways of meeting our basic needs for food, energy, and waste disposal. In my work I have witnessed a deep and fundamental contradiction between humankind’s remarkable capacity for technological innovation and its ignorance, even blindness about the consequences of modern innovations - what economists call *externalities*.

Climate change, the disappearance of farmland and the shrinking number of small and mid-sized family farms, the national epidemic of obesity, diabetes, and cancer, and the widespread toxification of our food, air, water, and soil are life-altering externalities. But even though these costly consequences are the direct result of all of our choices and behaviors, our economic report cards, profit-and-loss statements, and balance sheets don’t mention them. This means that the industrial and agricultural enterprises, political policies, and consumers whose decisions have spawned the worrisome consequences are escaping accountability. Our failure to capture the costs of this misconduct highlights a fundamental flaw in the design of modern life that has extraordinarily wide ramifications.

Humankind is facing unprecedented challenges to feed, fuel, and support life in the twenty-first century, and any solution must begin by reexamining how we measure success and how we apportion responsibility for unwanted outcomes. Any chance of avoiding ecological or economic bankruptcy depends on business and

governmental leaders - and, ultimately, every person on this planet - being held accountable for activities that pollute the environment, deplete our natural resources, or precipitate health problems.

Consider national health care. We already know that the twin plagues of obesity and diabetes cost the United States at least \$200 billion annually to treat. And the potential price tag for cancer treatments is growing by the minute. Not long ago, the prestigious President's Cancer Panel estimated that 41 percent of Americans alive today will be diagnosed with some form of cancer. The bill for treatment, according to economists, will climb into the trillions, quite possibly bankrupting the nation.

What these illnesses have in common is that, in most instances, they are food-based and preventable. We have diet and lifestyle alternatives that can help protect us from these deadly illnesses. For instance, the president's panel identified chemicals in our food supply as a major contributor to rising cancer rates, and Americans wishing to avoid becoming part of the 41 percent were advised to eat food free of toxic chemicals.

Admittedly, large-scale behavioral change won't be easy. But if we want to reduce the damage to our national health, we've got to make a start, and a good place to begin, in my opinion, is to acknowledge that we're not quite as smart as we think we are. A bit of humility, combined with a more thoughtful approach to new technological solutions, embracing the precautionary principle before we leap ahead, makes eminent sense.

Despite the technological and societal progress of the twentieth century, there is plenty of room for improvement. Our successful efforts stand side by side with the not-so-successful, even deadly missteps. Take the widespread and reckless use of DDT. Generations of people were exposed to that carcinogenic synthetic insecticide in the air they breathed, the soil enveloping their food crops, and the

water they drank. Or how about Agent Orange? Vietnam War veterans and their families, not to mention untold numbers of Vietnamese, have suffered and will continue to suffer from birth defects and various types of cancer and respiratory, nerve, digestive, and skin disorders related to their exposure to a deadly defoliant used to expose enemy soldiers.

My work in the food industry over the last three decades has heightened my awareness of the problems created by not owning up to past environmental negligence and taking far too few precautions in our everyday lives. I have witnessed too much carelessness to remain silent. For the sake of our children, our behavior must change.

It was with this perspective that I turned my attention in the summer of 2010 to the U.S. Department of Agriculture's imminent approval of genetically modified alfalfa for widespread use in the United States. Alfalfa is used mostly as food for animals, specifically dairy cows. The new alfalfa species that was being proposed is genetically engineered to be herbicide-tolerant, thus allowing farmers to spray more weed-controlling herbicides without harming the alfalfa crop. I feared that our organic dairy farmers' fields would be contaminated with seeds from transgenic, genetically engineered (GE) alfalfa, thus leading to widespread GE pollution. Were that to occur, the organic farmers would lose access to their markets, because organic regulations specifically prohibit the use of genetically modified crops either as feed or as product ingredients. Consumers and customers here and abroad expect that prohibition to keep GE crops out of the organic food supply. Wisely, a growing number of companies and organizations test to verify that GMOs are not finding their way into organic food.

I was also worried about the implications of the new technology for non-organic farms, who would then be encouraged to use herbicides to solve a problem that really doesn't exist. The USDA

estimated that only 7 percent of alfalfa was sprayed with an herbicide before the producers of the new species requested deregulation for commercial use. Obviously, the growers saw little need to douse their crops with chemicals of any kind.

I had seen this movie before. In the 1990s, the Monsanto Company had used its considerable financial clout to win regulatory approval to market genetically engineered recombinant bovine somatotrophin (rBST), colloquially known as synthetic growth hormone or rBGH. Despite compelling evidence that the drugs' commercialization could have negative health and financial consequences, our government decreed that the absence of definitive studies quantifying any problems meant that Monsanto should be free to sell its products.

Two decades later, it is clear that routine rBST use comes at a heavy price, both for cows and people. As with any other performance-enhancing drug, rBST forces dairy cows to produce an abnormal amount of milk, thus putting extra strain on the animals and increasing the frequency and severity of mastitis, an infection of the udders. The greater incidence of mastitis triggers increased use of antibiotics, which, in turn, creates more antibiotic-resistant bacteria.

Undoubtedly, dairy farms are a major breeding ground for antibiotic-resistant bacteria, some of which find their way to humans, causing hard-to-treat, even life-threatening infections. There is also evidence that rBST use increases the levels of insulin-like growth hormones in milk, chemicals that have the potential to disrupt normal patterns of development in teenage girls and to promote the proliferation of cancer cells.

Worse yet - Monsanto's considerable investment in research, lobbying, and public relations notwithstanding - the company's genetically engineered drug did not deliver the promised financial benefits to the farmers. What it did deliver were new risks, sick cows,

and added costs - so much of the latter, in fact, that Monsanto exited the business and sold the drug to Elanco four years ago.



Photo credit: Jim Richardson

Conventional dairy farmers eager to use every new production-enhancing technology quickly adopted rBST in the early 1990s, but enthusiasm for the drug waned as it's full costs and adverse impacts on cow health, rates of mastitis (a common udder infection), and reproductive performance became clear.

Genetically engineered crops appear to be leading us down the same problem-strewn path. Biotech companies, driven by the promise of substantial profits from both their patented seeds and the increased chemical use that results, are investing heavily in research designed to justify the need and value of new, patented genetically engineered crops and organisms. They are spending still more millions on lobbying and - especially in the wake of the Supreme Court's landmark Citizens United decision - filling the campaign coffers of politicians

who agree to advocate for their campaign donors. The biotech companies are also helping to bankroll a \$30 million public-relations effort under the guise of a new organization called the U.S. Farmers and Ranchers Alliance (USFRA) to “educate” consumers about the supposed benefits of modern industrial agriculture.

I fear that the excessive lobbying and spending by the biotech industry will doom any sort of rational precautions. Our government is being manipulated into dispensing with independent research that might test or disprove biotech industry claims. Our belief in a government of, by, and for the people is being sorely tested as we see our elected and appointed representatives working on behalf of the corporations that will profit from these questionable, even dangerous technologies.

Average consumers are being left to fend for themselves, and that might be fine if we had some way of knowing whether the foods we see at the supermarket contain the new organisms. A label identifying the presence of these ingredients, such as is required in the European Union, Japan, Australia, and even China, would at least give American consumers the choice to buy and consume these products or not. But the producers and sellers of genetically engineered crops are going to great lengths to ensure that U.S. regulators won't require labeling, dispensing without our right to know what we are eating.

Biotech companies claim there is no reason to include genetically modified ingredients on a product label because their safety is beyond question. My colleagues and I believe just the opposite: We think there is a long and troublesome list of reasons for concern, many of which will be described in this book.

The biotech companies also argue that consumers wishing to purchase foods with no genetically engineered ingredients should just buy organic foods, since organic regulations prohibit genetically engineered ingredients. While this sound advice could prove a boon for

my business, it is not presently a viable solution for most consumers. Organic foods make up only about 5 percent of U.S. food purchases and are not always stocked in the stores where many Americans shop. And because organic crop growers receive little or no taxpayer-funded subsidies - unlike those showered on major non-organic operators - the organic products tend to be more expensive than their conventional counterpart.

But even if organic foods were widely available at the same prices as conventional foods, the biotech argument still misses the point. My co-authors and I believe that our entire planet is likely to suffer severe health and environmental consequences if the deregulation and expansion of genetically engineered crops on America's farms is allowed to continue. Furthermore, we believe that any objective analysis of the worrisome issues we raise will lead others to share our concerns. Finally, we believe that in a democracy, all citizens should have the right to choose what they wish to eat, what they wish to grow, and what to feed their families.

We have written this book so that you can decide for yourself. My two colleagues - one an esteemed agronomist, the other a seasoned agricultural researcher and analyst - have been on the vanguard of the scientific debate surrounding genetic modification for years. I am a businessman, environmentalist, and father who feels strongly that the time has come for each of us to take responsibility for the health and environmental consequences of our actions and choices. Future generations are depending on us to make correct decisions today.

At the end of the day, we all are, and will forever remain a reflection of what we eat. The more we know about our food, and the deeper we think about the consequences of our food choices, the sooner food and the American diet will flip from a major driver of disease and lost human potential to just the opposite -- preventive health care and a universally accessible means to a fuller, healthier life.

LABEL IT NOW: WHAT YOU NEED TO KNOW ABOUT GENETICALLY
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We believe the labeling of GMO foods is an essential, long overdue first step in the right direction.

Gary Hirshberg

Londonderry, New Hampshire

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Chapter 1

ROUNDUP'S LEGACY

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Large herbicide application equipment can spray Roundup on several hundred acres of GE soybeans in a single day.

Pesticides are raining down on America’s heartland.

According to scientists at the U.S. Geological Survey, glyphosate, the active ingredient in the herbicide Roundup, produced by **Monsanto**, is now a common component of the air and raindrops in the Midwest.²

How did Roundup come to be a part of the clouds in the sky and the air we breathe?

Farmers have been spraying the herbicide on their fields and pastures since the 1970s, and for many years it has been the most widely used agricultural pesticide in America and the world.³ Yet, not until recently did the United States Geological Survey (**USGS**) begin detecting glyphosate in routine studies conducted to monitor chemicals in the air and rain. Why the sudden spike in glyphosate, i.e., Roundup usage? The authors of the studies point to the production of genetically engineered (GE) crops: “The relatively elevated levels of

glyphosate probably are due to its frequent use in these agricultural areas in conjunction with the genetically modified crops.”

Why are U.S. farmers suddenly spraying hundreds of millions of pounds of the herbicide Roundup annually on their genetically engineered crops? Simply put, because they can. Spraying Roundup right onto crops and the weeds growing in a given field is no longer a danger now that the crops have been redesigned via GE to tolerate glyphosate (Roundup), a chemical that otherwise would be just as toxic to the farmer’s crop as it is to weeds.

Farmers use herbicides to control various types of weeds, typically spraying them when weeds first start to grow but before the crops begin to emerge (hence not spraying the herbicide onto the crop). Once the corn or soybean or cotton plants begin to sprout, Roundup would kill the planted crops along with the weeds. That, at least, was the case until the advent of crops genetically engineered to tolerate applications of Roundup. This scientific breakthrough allowed farmers to spray an entire field with Roundup without fear of killing their crop. The crops continue to grow, and the weeds, theoretically, die.

Today, nearly 90 percent of corn and more than 90 percent of soybeans planted in the United States are genetically engineered, and essentially all are engineered to resist Roundup. The explosion of herbicide-tolerant (HT) crops since 1996 has, in turn, led to a dramatic increase in the use of Roundup. In each of the 10 years through 2006, soybean applications jumped by 9.8 percent annually, while in the 11 years ending in 2007, cotton applications leapt by a remarkable 18.2 percent *per year*.⁴

Bluntly put, hundreds of millions of additional pounds of Roundup have been applied to U.S. fields since the introduction of HT crops, setting in motion a vicious cycle: Having been subjected to regular applications of Roundup, the weeds have evolved resistance to the herbicide, prompting farmers to apply still more Roundup, along

with other herbicides on their fields in an attempt to control the mutants. In an ironic display of natural law, the emergence and spread of Roundup-resistant weeds ends up driving further increases in herbicide use.⁵ At least seven common types of weeds are now Roundup resistant.⁶

The area infested with resistant weeds in the U.S. expanded more than fivefold from early 2007 through 2011, widening from 2.4 million acres to some 13 million acres across 26 states. Already half the size of Ohio, the area invaded by the superweeds shows no signs of shrinking. Indeed, Chuck Foresman of **Syngenta**, an agribusiness company that develops GE crops, expects the infestation to double in size by 2015.⁷

Scientists have sounded the alarm, predicting dire consequences and enormous new costs for farmers. Two Iowa weed-science specialists recently warned that there are no viable herbicide options for mid-season weed outbreaks, leaving growers dependent on mechanical control, i.e., cultivation during the growing season and deep tillage prior to planting.⁸

Problems triggered by resistant superweeds are already imperiling cotton and soybean production in the Southeast⁹ and the weeds are now emerging and spreading with a vengeance in the Midwest.¹⁰



Photo Credit: Palmer amaranth, Rebekah D. Wallace, University of Georgia,

bugwood.org

Roundup-resistant amaranth growing in a cotton field.

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**Photo Credit: Palmer amaranth, Rebekah D. Wallace, University of Georgia,
bugwood.org**

Roundup resistant Palmer amaranth, a form of pigweed, grows rapidly in the hot, humid conditions in Southeastern cotton fields. The stalks can approach the size of a man's wrist and are so tough when dry that they can break the cutter bars on cotton harvesting equipment.



Photo Credit: Brad Luttrell, bradluttrell.com

To deal with Palmer amaranth resistant to all available herbicides, some farmers in the Southeast have resorted to “choppin’ cotton” with hoes, a very difficult, costly method of weed control not relied on commercially for about a half-century in the U.S.

Farmers long dependent on Monsanto’s relatively simple and previously effective Roundup Ready weed-management system are now plagued with costly adjustments and an uncertain future. In an increasingly desperate attempt to control glyphosate-tolerant weeds, many are turning to herbicides far more toxic than glyphosate. **Dicamba** is one such weed killer and **2,4-D** an ingredient in Agent Orange, is another.¹¹ Despite well-documented human health risks (see below), biotech companies are developing GE crops that are resistant to both, a move that could dramatically increase the use of these toxic chemicals. The biotech industry-driven rush to radically expand reliance on these high-risk herbicides is deeply troubling in light of the steady progress over 20 years in reducing their use to nearly negligible levels in most major farming regions.

“The cavalry is coming,” declared a Monsanto executive.¹²

Unfortunately, the replacement troops consist of potentially carcinogenic chemicals known to cause reproductive problems and birth defects.¹³ The companies selling the GE seeds, as it turns out, also market many of the herbicide replacements, and we are already seeing disturbing trends in the use of these more toxic products.

In 2004, the **USDA's** pesticide use data showed that only about 3 percent of corn, soybean, and cotton acreage was treated with 2,4-D, while around 9 percent is so treated today. That leaves a huge portion of crops that are not currently treated with 2,4-D. So if the government were to approve GE, herbicide-tolerant crops resistant to 2,4-D or dicamba, as much as 30 percent of corn and soybean acreage would likely be sprayed with the high-risk chemicals. Translation: some 20 million pounds of the chemicals would be applied annually.¹⁴

Might 2,4-D and dicamba start to appear in the rain next, mixing in with the glyphosate? Given the known hazards associated with these herbicides, how would our health be affected? Might our children's health and development be altered?

The increasing use of dicamba and 2,4-D poses numerous risks to the health of farmers, farm workers, and anyone accidentally exposed to these herbicides. Members of the phenoxy family, a group of chemicals related to growth hormones, they have been implicated in reproductive abnormalities. One study in Ontario, Canada, found that exposures to 2,4-D and dicamba increased the risk of spontaneous abortions by 50 percent.¹⁵ Another study determined that parental exposure to dicamba three months before conception through the first trimester of pregnancy increased birth defects in male babies by nearly two-and-a-half times.¹⁶

In a Minnesota study led by Dr. V. F. Garry, scientists compared the rates of three categories of birth defects - circulatory/respiratory, skeletal, urogenital - and the male-to-female ratio of births in areas heavily treated with phenoxy herbicides to areas with minimal

agricultural production and herbicide use. Babies born six to nine months after the heavy herbicide-spraying period in the spring were 47 percent more likely to be diagnosed with one or more birth defects, compared to babies born in the same time period but in non-agricultural areas.¹⁷ A developing fetus is far more vulnerable in the first trimester of pregnancy, which accounts for the heightened vulnerability to herbicide-triggered abnormalities in the early stages of fetal development.

The herbicide-related problems aren't confined to birth defects. Both 2,4-D and dicamba are known to travel around the landscape, either drifting on the wind after application or turning to vapor afterwards. But no matter where the herbicides land, destruction follows: plant development is disrupted and backyard gardens and nearby crops often wither and die. The stealth killers typically leave no trace, just confusion and disappointment as people try to sort out what happened to their seemingly healthy plants.



Chapter 2

WHERE ARE THE REGULATORS?

Alarming on its own, the proliferation of GE crops and the accompanying surge in herbicide use is of even greater concern given the government's inadequate approach to oversight of these chemicals. Once on the market, a pesticide is deemed safe until it is shown to cause "unreasonable adverse effects on man or the environment." The government must make the case that the chemical's routine, legal uses have created serious human health or environmental problems. The burden of proof is exacting, and the chemical companies are masters at raising doubts about **Environmental Protection Agency** (EPA) risk assessments.

In many instances, manufacturers have dodged regulatory bullets by weighing down the EPA with more studies, more expert opinions, and a flood of protest letters from farmers. Then, too, hard-fought pesticide regulatory reviews may end with a whimper when the EPA decides it cannot meet the burden of proof. Typically, the manufacturer then agrees to a few modest labeling changes designed to mitigate future high-risk applications, and everyone returns to business as usual.

Apart from regulatory shortcomings, pesticide risk-assessment science itself is inadequate. Take the possibly interrelated effects of the various pesticides and other chemicals to which Americans are exposed on a daily basis. The most recent "body burden" report from the **Centers for Disease Control** (CDC) examined 5,000 people and reported finding a total of 212 different chemicals in the subjects' blood, bones, and tissue.¹⁸ In 2009 testing, the nonprofit **Environmental Working Group** detected a remarkable 232 chemicals in the umbilical cord blood of 10 babies.¹⁹

Excepting those who eat organic foods, the average adult consumer is exposed to between six and twelve pesticides each day via his or her food and beverages.²⁰ Yet we have no idea how chemical combinations affect children and what level of exposure, if any, is

safe during fetal development and early childhood. Most of the mammalian-risk pesticide safety studies have been conducted by the product makers themselves, and they focus on how pesticides affect healthy adult mice and rats. A seminal [National Academy of Sciences](#) study²¹ published in 1993 declared that the nation's pesticide regulatory policy might adequately protect the health of adult rats, but it was woefully inadequate for protecting the health of pregnant women and infants and children.

Nearly two decades later, we're still ignorant about the safety of these compounds because the government has not insisted on subjecting contemporary pesticide usage to twenty-first-century risk-assessment science. Thus, under EPA policy and current law, the compounds already on the market remain innocent until proven guilty.

Compelling support for stronger pesticide regulations has come from an unexpected quarter, the White House. The President's Cancer Panel, established in 1971 and comprised of three distinguished experts, reviews America's cancer program and reports directly to the president.

Its 2010 report was a comprehensive, 240-page document that confirmed the link between environmental toxins, including pesticides, and cancer.²² It's worth noting that the scientists who produced the 2010 report were appointed to the panel by President George W. Bush. Calling the panelists "the Mount Everest of the medical mainstream," *New York Times* correspondent Nicholas Kristof pronounced himself astonished "to learn that [the panel] is poised to join ranks with the organic food movement and declare: chemicals threaten our bodies. . . . While the dangerous effects of cancer-causing chemicals and toxins on the American people and worldwide has long been speculated, this report alarmingly confirms that 'The true burden of environmentally induced cancers has been grossly underestimated.'"²³

The finding that hits the hardest in this undeniably disturbing

report, however, is this: 41 percent of Americans will be diagnosed with cancer at some point in their lives and exposure to chemicals in our environment and food is the number one cause. Pesticides, including those being applied at a rapidly increasing rate in conjunction with GE crop production, are among the chemical culprits.

The panel recommended that we enforce precautionary principles, or, as publisher **Maria Rodale** puts it, “what all moms have been saying since the beginning of time: better safe than sorry.”

Has our government learned anything as the evidence has mounted that our federal regulation of pesticides is inadequate? One would hope that we’d be taking a more prudent approach to regulating GE crops, but unfortunately this is not the case. To understand the degree to which government oversight of the issues associated with GE crops has failed, it helps to look in the rearview mirror. During the presidency of George H. W. Bush, the White House Council on Economic Competitiveness, led by Vice President Dan Quayle, issued a set of recommendations at a Biotechnology Industry Organization (BIO) meeting that were designed to maintain U.S. leadership in the emerging biotechnology industry. The announcement was advertised as a “deregulatory initiative.” Ever since, the USDA and the **Food and Drug Administration** (FDA) has been regularly green-lighting the release of new GE crops without requiring that their safety be proven.

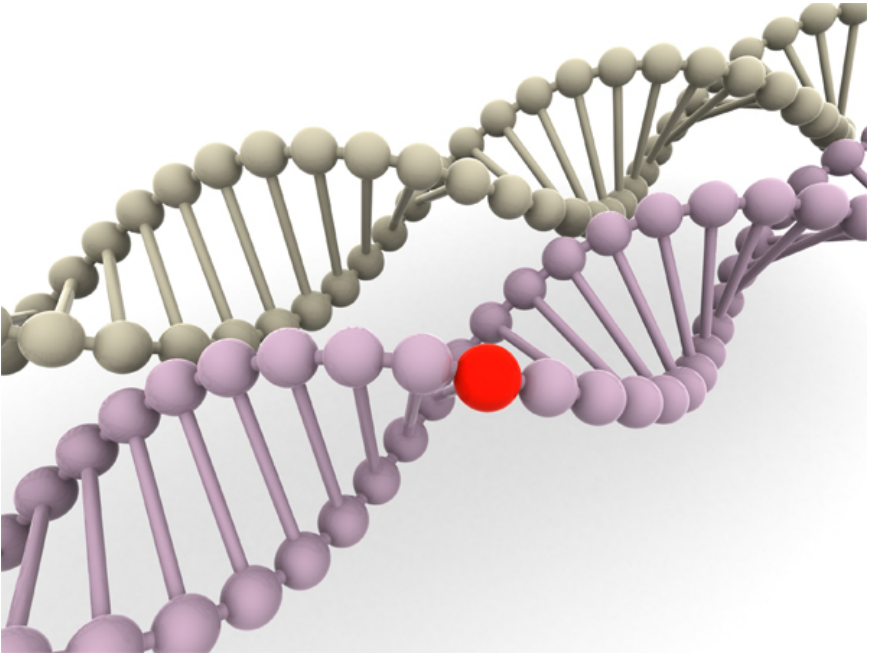
Just as the impact of pesticides on our health adds up to a compelling moral, ethical, scientific, and economic case for rethinking our approach to pesticide regulation, the information about GE crops now coming to light should serve as a wake-up call for all of us. It’s time we knew more about this relatively new technology and the changes it is causing in our diets and the environment. And it’s past time for our elected representatives, the Department of Agriculture, the Food and Drug Administration, the Environmental Protection Agency, and other government regulators to do their jobs by putting consumers first.



Chapter 3

THE BRAVE NEW WORLD OF GE

LABEL IT NOW: WHAT YOU NEED TO KNOW ABOUT GENETICALLY
ENGINEERED FOODS



Advances in the fields of molecular biology and genetics are rapidly changing our understanding of how genes and the environment interact. Increasingly, science is proving that environmental toxins alter gene expression, triggering “epigenetic” changes, some with serious and adverse, life-long consequences.

Farmers and scientists have been breeding plants for thousands of years. They saved seeds from varieties that did especially well under particular growing conditions, and they cross-bred varieties of plants to develop new cultivars with even more desirable characteristics. But GE crops are different at the genetic and molecular levels, and biotech companies must document these differences when they apply for a patent on a new variety. If there’s nothing novel about the engineered crop, the patent application will be denied.

Genetic engineering is obviously a dramatic departure from traditional plant-breeding methods. It does not rely on the age-old

reproductive mechanisms of plants to develop more insect and disease-resistant and productive crop varieties. Like artificial insemination, GE depends on techniques outside of the natural order to take DNA from one species and insert it into another. The process itself can damage or disrupt the way a plant's genes control development and physiological processes, or the way it responds to various sources of stress. Scientists are still discovering the ways in which these new genes sometimes alter other functions within the plant, with unpredictable consequences.

How embedded are the GE crop-production methods in the United States? The first commercial crops were planted in 1996, and the methods were rapidly embraced by corn, soybean, and cotton farmers. Today, the most commonly planted GE crops are those that are herbicide tolerant, insect resistant, or both, with a growing percentage claiming more than one new trait. For instance, a crop may be resistant to multiple herbicides or carry traits for both herbicide tolerance and insect resistance.²⁴ One variety of GE corn, SmartStax, contains eight – two for herbicide tolerance and six different *Bt* genes.

Certain fruits and vegetables are genetically engineered, but only papaya and a few squash varieties are available commercially. That may change in the summer of 2012, because Monsanto is now selling a GE variety of herbicide-tolerant and insect-protected *Bt* sweet corn. (*Bt* sweet corn - the *Bt* stands for *Bacillus thuringiensis*, a naturally occurring soil bacterium - is built to thwart the European corn borer and other pests.) With the exception of rice,²⁵ no small-grain crops such as wheat, oats, and barley are genetically engineered as of now. Nor are there any GE fruits, vegetables, or small grains in the regulatory pipeline that are likely to be approved and planted widely in the next few years.²⁶

Increased herbicide use isn't the only way GE crop production threatens our health. The consumption of GE crops introduces

potential new health risks in ways we are just beginning to understand. The aforementioned *Bt* corn crop, for example, is engineered to express a naturally occurring bacterial toxin in plant cells so that insect pests biting into the plant or feeding on its roots will ingest the toxin and die.

But the *Bt* corn toxins are now showing up in human bloodstreams and, more disturbingly, in the umbilical cord blood of pregnant women. Scientists have no idea how the toxin affects gene expression and development in the womb, or during the first years of life when a child's organ systems are rapidly developing, often in response to subtle cues from the environment. Furthermore, other studies have raised concerns that GE foods might be spawning new allergies and introducing new toxins into our diets.

The federal government approved the first GE seeds in the 1990s based on "voluntary" safety consultations and presumed "substantial equivalence" with non-GE seeds. "Equivalence" in this case referred only to the protein, fiber, vitamin, and mineral levels in GE crops. The governmental authorities did not require evidence-based research to determine whether GE foods might be harmful to human health. Essentially, they required no scientific studies at all. For people with chemical or food allergies and sensitivities, those battling chronic disease, women who were pregnant, infants and children with undiagnosed conditions, the government and industry have little to say about the risks stemming from GE foods because they have done no studies to assess such risks.

Nor were independent studies conducted to discern the risk of cancer, birth defects, reproductive problems, or immune system issues related to GE food. Could GE crops trigger food allergies? Given that essentially all such crops manufacture novel proteins, it was a distinct possibility, but no one knew for sure. In short, first-generation GE crops entered the U.S. food supply on a giant leap of faith.

Since a high percentage of soy, cotton, corn, canola, and sugar beets planted in the United States today are genetically engineered,²⁷ it follows that most of us consume GE crops every day in the processed foods we eat. Nearly all animals on conventional livestock farms consume genetically engineered feed, and many do so almost every day of their lives. So unless animal products like eggs and milk and processed foods containing corn, soy, cotton, canola, or sugar beet derivatives are certified organic or labeled GE-free, they almost certainly contain genetically engineered proteins. Corn, canola, and soybean oils, high-fructose corn syrup, soy lecithin, emulsifiers, non-cane sugar, and cottonseed oil are likely to be derived from GE raw agriculture products.

Something's Fishy

Genetic engineering is not just limited to plants. Scientists are also working on developing genetically engineered livestock and fish, though so far, none of these GE cows, pigs, chickens, or fish have gotten anywhere near our dinner plates. But a change may be in the offing: The U.S. government is considering whether to approve a GE variety of salmon. As of this writing, reports indicate that the FDA has recommended approval of GE AquAdvantage Atlantic salmon.

Genetically engineered salmon can grow five times the rate of wild fish, reaching market size at warp speed when fed high-energy diets that include feed grains like corn. If you're thinking that corn, not known as a seafood staple, is the growth engine, think again. The speedy growth, it turns out, is brought about by the addition of a gene from the ocean eelpout and a growth hormone gene from Chinook salmon. The GE technology effectively turns wild salmon into animals that can be raised in tight quarters and fed a corn-based diet, much like pigs on a Midwestern livestock farm.

A scientific advisory committee convened by the FDA to review

the AquaVantage application raised serious questions about the data and science related to food safety and nutritional equivalency. For example, the data provided by AquAdvantage was based on tests on fewer than a dozen GE fish. In addition, there were subtle differences between the fish being tested and the fish the company proposed to commercialize. Then, too, the tests were done in small vats and the fish were fed diets different from what would be used in commercial production. In short, the science was shoddy, leaving vital questions unanswered and unanswerable.

Our experience leads us to question whether these GE salmon will have the same nutritional value as their wild cousins, particularly their omega-3 and omega-6 fatty acids. Western diets typically lack heart-healthy amounts of omega-3 and contain excessive levels of omega-6. Many people seek out wild salmon because it contains high levels of omega-3, so consuming the wild salmon can help balance the ratio of omega-3 and omega-6 fatty acids in one's diet.

But switching salmon from their fish-based diet in the wild to a grain-fed diet supplemented with fish is bound to increase omega-6 fatty-acid levels and decrease omega-3, undermining the unique nutritional benefit of eating wild salmon. And, in fact, data on the nutrient composition of AquAdvantage salmon suggest that the omega-6:3 ratio is about one-third higher than that of wild Atlantic salmon, confirming concerns that the GE fish will be less nutritious.²⁸

Environmental problems also loom - from water pollution to threats of disease in wild-fish populations and genetic drift if GE fish escape into open water.²⁹

Are GE Foods Healthy? Who Knows?

Given that GE foods have made up a growing share of our diet for more than 15 years, why don't we know more about how GE crop technology impacts our health?

Answer: Since GE foods are exempt from labeling, people have no idea when they are ingesting them. Their doctors are equally clueless, making it virtually impossible for them to assess whether exposure to proteins in GE foods is causing or contributing to a patient's health problems. In addition, the lack of labeling stymies researchers conducting large-scale studies on the impact GE food has on public health.

Worse yet, the combination of inadequate government oversight and strong patent laws has made the biotech companies the sole arbiters of their products' safety.

Following the deregulatory strategy laid out in Dan Quayle's 1992 biotech policy recommendations - which one observer at the time labeled "reckless" - the FDA only engages in "voluntary safety consultations." At the molecular level, as the thinking goes, genetic engineering is simply an extension of traditional breeding methods "and will be used to achieve the same goals as pursued with traditional plant breeding."³⁰ Thus, to win approval a biotech company need only show that a new variety has roughly the same nutritional value as its non-GE counterpart.³¹ The new crop's safety is presumed unless the company uncovers and brings to the FDA's attention reasons to suspect otherwise. That, of course, is a rarity.

The government conducts no routine independent testing of GE crop safety or performance. Nor does it question the quality of the data submitted by the companies or the soundness of their experimental designs. It simply acknowledges receipt of a company's safety assessment when a new GE crop is introduced. For example, in the FDA's September 25, 1996, response to Monsanto following a voluntary safety consultation on insect-resistant corn, the agency wrote:

Based on the safety and nutritional assessment [Monsanto

has] conducted, it is our understanding that Monsanto has concluded that corn grain and forage derived from the new variety are not materially different in composition, safety, or other relevant parameters from corn grain and forage currently on the market, and that they do not raise issues that would require premarket review or approval by FDA.

Similar language appears in nearly every letter sent by the FDA to companies concluding so-called safety consultations.

There might be less cause for concern if the government didn't allow the biotech companies to shield their GE technology from testing by independent researchers. But the biotech industry uses patent law to tightly control who can perform research on GE crops - even after those crops become commercially available. Companies routinely deny access to the technical tools and information needed by independent scientists wanting to carry out cutting-edge risk assessment science on new GE crops. And without independently conducted research, there is good reason to be skeptical of the safety of biotech crops. The foxes, it seems, are standing sentry at the henhouse door.

Despite numerous calls for more rigorous and independent scientific assessment of possible GE food health risks,³² the U.S. regulatory and research stance has not budged in 15 years. The scientific literature contains only a handful of studies on the health effects of GE foods, and most published studies are industry sponsored or heavily influenced by industry scientists. They typically concern themselves with the food's nutritional content, and most conclude that GE foods are not "significantly" different from conventional foods.

But even with such a narrow focus, what does "significantly" really mean?

Who Can You Trust?

When industry-funded studies conclude that there's no significant difference between GE and non-GE foods, they are referring to nutritional content only. The industry data usually compare micro- and macro-nutrient levels in GE food with the same food grown from the non-GE plant variety. Most company studies do, in fact, find large differences - greater than 20 percent - in at least a few specific nutrients. But they dismiss the differences as falling within "normal" ranges observed in past studies. The problem is these past studies were conducted in different regions and years, and on different soil types. The very purpose of carrying out new side-by-side studies of GE and non-GE crop varieties is precisely to eliminate the impacts of variable weather and soils. The FDA's uncritical acceptance of this essentially bogus industry argument has turned it into a loophole wide enough to accommodate almost any GE crop.

Also telling is a study of 94 GE food-related papers in peer-reviewed journals that found "a strong association . . . between author affiliation to industry (professional conflict of interest) and study outcome."

Most studies carried out by independent scientists find at least some data suggesting that GE foods are related to one or more health and/or environmental problems. What is more, academic and USDA scientists have clear-cut, documented evidence of adverse impacts on soil and plant health,³³ nitrogen availability,³⁴ non-target organisms such as earthworms,³⁵ water-use efficiency,³⁶ and aquatic ecosystems in Midwestern streams³⁷.

Looking at the independent studies that have evaluated the impacts of GE crops, we have compiled here some of the more concerning findings about GE-crop health effects.

- *Are GE-produced insecticides in our bloodstreams?*

The natural, protein-based toxin *Bt* has long been used as a bio-insecticide in liquid sprays to control certain agricultural insect pests. It is even approved for use in organic agriculture because it is derived from natural sources and is essentially non-toxic to mammals, including people.³⁸ However, naturally occurring *Bt* insecticides are entirely different from the genetically engineered version. *Bt* corn and cotton have been engineered to produce an altered version of the bacterium *inside the plants* that is more toxic to insects than the natural counterpart. The altered *Bt* proteins remain in the GE plant, including in the corn kernels, up to harvest and enter the human and/or animal food supply.

Despite its substantial differences, the engineered *Bt* has never been thoroughly investigated for its effect on human or animal health. All that's been done is a cursory review of *Bt* corn designed to discern similarities with known food allergens, and this critical assessment is always done or paid for by the company seeking government approval of a new GE crop.

Why did federal regulators decide not to assess the potential health risks created by *Bt* corn as part of regulatory review and approval? Yet again, the federal government bowed to the biotech companies. They told the FDA that transgenic *Bt* proteins in corn couldn't survive the acidic conditions in the human stomach for more than a few seconds. Hence, they argued, these proteins could never get into our bloodstream and, therefore, the *Bt* proteins could never trigger any health effects. The biotech companies' tidy and convenient argument was accepted by regulators around the world.

Then, in the summer of 2011, a study challenging the industry's patent explanation was published by a group of Canadian physicians. The doctors were curious as to whether pregnant and non-pregnant women they encountered at their hospital were being exposed to the herbicides associated with GE crops or to one of the most common *Bt*

proteins in GE corn.

The team detected *Bt* proteins in 93 percent of blood samples from pregnant women, in 80 percent of umbilical-cord blood samples, and in 69 percent of blood samples from non-pregnant women.³⁹ Their findings upset the conventional wisdom about *Bt* being destroyed in the digestive system and raised new concerns about what insect-resistant GE crops were doing to our unborn children, and indeed, everyone else.

How did the *Bt* proteins get into the women's blood? One theory advanced by the Canadian team is that they entered via the consumption of animal products such as milk, eggs, and meat, because the relevant animals were all likely to have been fed *Bt* corn.

As the Canadian study makes abundantly clear, there are immensely important reasons for conducting careful research before sanctioning widespread planting of GE crops. Yet, to our knowledge, no government agency anywhere in the world has studied the pre-natal developmental effects caused by *Bt* toxins in human or animal food.

• *Are allergies being engineered?*

A food allergy is an exaggerated immune response triggered by a specific food.⁴⁰ Four out of every 100 children have a food allergy.⁴¹ In the decade ending in 2007, the incidence of food allergies among children rose by 18 percent, and among children with a food allergy, almost 30 percent also suffer from asthma, according to the CDC. A study in Great Britain found a 500 percent increase in hospitalizations linked to food allergies.⁴² Scientists believe that for every reported case of food allergy, two to three go unreported.⁴³ If so, as much as 10 percent of children in the United States may suffer from a food allergy. We know that soy-related allergies, especially among children, are increasing, and corn-related food allergies, though less common, are also on the rise.

Food allergies are related to a type of allergy-producing

substance your body makes called immunoglobulin E (IgE) antibodies in response to a particular food that your immune system deems unsafe. It produces antibodies and histamine in response to the specific food. Many people have a food intolerance, but true food allergies are less common.⁴⁴

Health status can raise or lower the chances of someone developing a food allergy. Different farming systems and varieties of plants can alter a plant's potential allergy-causing properties.⁴⁵ And without doubt, there is a link between exposure to novel proteins and food-driven allergic reactions.

When the first GE crops were marketed, they contained one of a half-dozen forms of *Bt* proteins. Now the GE crops being sold, including new versions of corn and cotton, contain multiple new varieties of the *Bt* protein. Suppose a child has consumed corn products with an older form of the *Bt* protein through age five, and then begins ingesting a similar but new *Bt* protein because new GE seed varieties have been commercially introduced.

Could the altered forms of *Bt* proteins in GE foods be recognized as foreign in some children, triggering an immune response and, for some, a new food allergy? And will the incidence of corn-related food allergies rise as GE corn varieties express multiple and different *Bt* proteins?

We don't know the answers to these questions. But we do know that when plants are stressed, they produce defensive compounds called pathogenesis-related proteins. Of the known food allergens produced by plants, about 25 percent are defensive compounds.⁴⁶ Their ability to pass through the human digestive system intact, for the most part, increases the likelihood of an allergic response being triggered. Scientists worry, and rightly so, about the production of new defensive compounds in GE plants and their possible impact as novel human food allergens.

The biotech-seed industry is pushing hard to create GE plants that are better able to withstand stress from viruses, bacteria, adverse weather, or soil imbalances. A common strategy involves either adding a new defensive compound to a plant or “up-regulating” an existing defensive compound, meaning it would be sent into overdrive. Both strategies increase the risk of novel food allergens. Scientists can and do screen GE proteins for similarity to known human allergens, but even the most careful screening cannot detect novel allergens, simply because they’ve never been identified before.

An independent study of GE peas found clear evidence that genetically altered proteins can cause an allergic reaction. A team of Australian and U.S.-based scientists fed the GE peas to mice and then closely monitored them for a reaction.⁴⁷ The mice that ate the GE peas exhibited a significant allergic reaction, while mice fed the non-GE peas displayed no allergic response. The study also found that exposure to the genetically altered proteins in the peas increased the likelihood that the mice would react to other proteins.

In 2010, the **European Food Safety Authority** (EFSA) issued a detailed “Scientific Opinion” that spelled out the need for a thorough assessment of whether GE foods increase the risk of developing allergies.⁴⁸ It explained why careful pre-market approval of allergenicity related to GE foods is crucial, and laid out the sort of tests required. To this day, not a single GE food on the market has been tested in accordance with the guidelines issued in the EFSA Scientific Opinion.

- *Are we engineering new toxins?*

Plant proteins change form numerous times between their development within a plant and the point at which they are processed and cooked as food, and again when they are digested after being eaten. When proteins change form, they often change their function as well. They are highly reactive, binding with sugars to form a dizzying

array of new molecules. Changes in the structure of proteins in GE plants can affect their reactivity, their ability to bind to cell walls, their toxicity, and their capability to provoke an allergic reaction. Environmental conditions - heat, for instance - can dramatically alter how proteins behave and whether a toxic or allergenic protein form will be produced.⁴⁹

The more a food is processed, the greater the chance its proteins will be profoundly altered. Genetically engineered proteins are present in essentially all first-generation GE foods at the time of harvest. Generally, the proteins change as the product moves along the food value chain. Some of the proteins will be fed to animals as GE grain, changing form as they move through the animal's digestive system. Others will be altered in the process of extracting oil from GE grain. A growing portion of America's GE corn crop will be channeled into ethanol production, its proteins altered in the distilling process. The distillers' grain byproducts, which contain altered GE proteins, are fed to animals. In each case, GE proteins are altered by processing and digestion, creating new proteins that our systems may never have encountered before.

Researchers are just beginning to explore what happens to altered GE corn and soybean proteins as they pass through various industrial processes. We know that GE food proteins have the potential to form toxic glycoproteins, or advanced glycation end-products (AGEs). The AGEs are formed when heat triggers a transformation of proteins and sugars. But to our knowledge, scientists have never monitored GE foods, high-fructose corn syrup, or the cooking oils derived from GE corn, canola, and soybeans for the presence of AGEs, even though these compounds are known to play a role in triggering diabetes. It's just one more reason why additional research must be completed before we can render a judgment, one way or another, on the food-safety risks associated with GE technology.

Questions obviously outweigh answers when it comes to assessing the safety of GE crops for human consumption or their effect on the environment. A major reason for the information imbalance is the unprecedented degree to which biotech companies have controlled research activities. Industry-funded scientists have even sought to intimidate others in their field who published negative reports about the impact of GE crops.

Bare-Knuckled Biotech Companies

In February 2009, 26 land-grant entomologists placed an anonymous comment on the official EPA docket concerning the review of requirements related to *Bt* corn Integrated Resistance Management (IRM) plans. As part of the EPA's regulatory oversight of GE crops producing plant-pesticides like *Bt*, the agency requires biotech companies to submit a plan for IRM. It must show how the crop can be produced in a way that slows or prevents insect pests from developing a resistance to the crop.

For instance, an IRM might require farmers who plant a certain variety of a GE crop to also plant a certain number of acres with non-GE seeds so that insect pests can feed on crops free of the GE pesticide. The availability of non-GE acreage slows the evolution of pesticide resistance in an area's insect pest population.

In this 2009 case, the review of IRM plans was critical to the EPA's re-assessment of its earlier approval of *Bt* corn. The land-grant entomologists' comment⁵⁰ reads in part:

Technology/stewardship agreements required for the purchase of genetically modified seed explicitly prohibit research. These agreements inhibit public scientists from pursuing their mandated role on behalf of the public good unless the research is approved by industry. As a result of restricted

access, no truly independent research can be legally conducted on many critical questions regarding the technology, its performance, its management implications, IRM, and its interactions with insect biology. Consequently, data flowing to an EPA Scientific Advisory Panel from the public sector is unduly limited.

In a chilling *New York Times* story, a signatory to the letter complained that the companies “have the potential to launder the data, the information submitted to EPA,” as a result of the restrictions.⁵¹ One company’s restriction on its *Bt* seed corn even prohibited the buyer of the seed from comparing the company’s seed to that sold by another company.

“Battlefield,” a major investigative story in the September 3, 2009, issue of the journal *Nature*, featured the following tagline: “Papers suggesting that biotech crops might harm the environment attract a hail of abuse from other scientists.”

The *Nature* story reported on the fallout from research by Emma Rosi-Marshall and a team of scientists who studied 12 streams in northern Indiana -- areas dominated by *Bt* corn. After two years of study, the team concluded in a peer-reviewed paper⁵² in the *Proceedings of the National Academy of Sciences* that *Bt* corn “may have negative effects on the biota of the streams in agricultural areas . . . with unexpected ecosystem-scale consequences.” Rosi-Marshall had found that a certain insect living in streams in agricultural areas gained weight more slowly when it ate residue from *Bt* corn than when the same type of insect fed on a similar variety of non-GE corn.

Within two weeks, *Nature* reported, other scientists with “vehement objections” had written letters to the paper’s authors, the journal itself, and the scientific team’s funder. The *Nature* story said that those “like Rosi-Marshall and her colleagues, [who] suggest that

biotech crops might have harmful environmental effects are learning to expect attacks of a different kind. These strikes are launched from within the scientific community and can sometimes be emotional and personal; heated rhetoric that dismisses papers and can even, as in Rosi-Marshall's case, accuse scientists of misconduct. 'The response we got - it went through your jugular,' says Rosi-Marshall."

As the debate over the paper widened and became more strident, many scientists stepped forward to defend the research or report similar results. Several scientists discussed comparable episodes of intimidation and reprisal with Emily Waltz, the *Nature* reporter.

Shockingly enough, agricultural biotech companies now control, to an unprecedented degree, what kind of research gets done and is considered by government agencies when it comes to assessing the safety and performance of their products. They have been remarkably successful in blocking academicians from conducting research on proprietary GE crops, whether it be efficacy studies, comparative yield experiments, human health assessments, or environmental studies. The well-financed campaign to keep independent scientists away from GE crop research goes a long way toward explaining why the industry still claims with a straight face that "crop modification by molecular methods is no more dangerous than crop modification by other methods."⁵³

Given that over 1.3 billion acres in the United States have been planted with GE crops in the past 16 years, it's long past the time when the government should fund independent research on the safety of GE crops.

Failed Promises

Knowing what we know about the risks of GE crops, why are we growing so much of them? The biotech industry is quick to suggest that GE crops will solve the problem of world hunger by boosting crop

yields and vanquishing weeds and insect pests.⁵⁴ We are frequently told that stronger regulation of biotech crops would devastate the industry and prevent GE crops from feeding the world. For example, in August 2011, biotech industry advocate Nina Fedoroff authored a piece in *The New York Times* captioned, “Engineered Food for All.” Fedoroff wrote: “The process for approving these [biotech] crops has become so costly and burdensome that it is choking off innovation. Civilization depends on our expanding ability to produce food efficiently, which has markedly accelerated thanks to science and technology.”

Her argument ignored the host of factors that determine whether people will go hungry - poverty for one, along with civil unrest, natural disasters, food waste, and issues with distribution and access.⁵⁵ ⁵⁶ But even if we don’t take these arguably more important factors into account, the biotech industry still has not demonstrated that GE crops can deliver on their promise to boost yields, and thus potentially make more food available for consumption. Genetic engineering has not increased average intrinsic crop yields so far,⁵⁷ and weeds⁵⁸ and insect pests⁵⁹ are quickly adapting to new GE technologies, dimming hopes that current GE technology can ever triumph over these rapidly evolving pest populations.

Doug Gurian-Sherman, a senior scientist with the Union of Concerned Scientists (UCS), an independent, science-based nonprofit that advocates for a healthier environment, explored whether GE crops are boosting yields. He scrutinized all major yield studies of the past two decades to see if genetic engineering had increased production. He concluded that GE crops have not delivered on their proponents’ promise to boost intrinsic yield potential. Undercutting biotech industry claims, he found that “no currently available transgenic [GE] varieties enhance the intrinsic yield of any crops. The intrinsic yields of corn and soybeans did rise during the twentieth century, but not as

a result of GE traits. Rather, they were due to successes in traditional breeding.”⁶⁰

Why is traditional plant breeding responsible for the improved yields on GE varieties? Here’s how: Biotech companies start with crops developed through traditional breeding techniques and then they add new genes. Gurian-Sherman explained that “conventional breeding methods, especially those using modern genomic approaches (often called marker-assisted selection and distinct from GE), have the potential to increase both intrinsic and operational yield.”

Gurian-Sherman also found that the new GE traits added other capabilities to the crops - such as the ability to be sprayed with herbicides - that are owned by the companies doing the genetic engineering in the first place.

These findings underscore the need for renewed investment in traditional plant breeding. Unfortunately, the trend has been in the opposite direction. Over the past 30 years, private investment in agricultural research has grown, while public investment has declined precipitously. If we want to see continued growth in agricultural productivity, coupled with progress in improving food safety and quality, this trend must be reversed.

The spread of herbicide-resistant weeds and insecticide-resistant pests are another reason today’s GE crops are unlikely to improve agricultural productivity. Over time, repeated applications of a single herbicide or insecticide - whether sprayed on or manufactured in the crop itself as with *Bt* corn - are likely to create resistance in targeted pests, especially when relied upon as heavily as U.S. farmers have relied on glyphosate and *Bt*.

Herbicide-tolerant and insect-resistant GE crops accelerate the emergence of resistant pests. Although farmers have used *Bt* insecticide sprays for decades, only a handful of *Bt*-resistant insects have emerged in regions where vegetable crops were sprayed with

Bt eight, 12, or more times in a season. After only five years of widespread commercial use, however, *Bt* corn for rootworm control has triggered *Bt*-resistant insect pests in several states.⁶¹



The European corn borer.

**Photo Credit: Clemson University - USDA Cooperative Extension Slide Series,
bugwood.org**

The biotech industry's response to the emergence of *Bt*-resistant insects has been to develop GE varieties with multiple forms of *Bt* toxins. It's a strategy destined to backfire because it is bound to accelerate and broaden the spread of *Bt* resistance genes. In the long run, this seemingly classic case of planned obsolescence will do more than damage biotech industry profits and leave farmers wondering "what now?" Soil ecology and plant-pest interactions may be altered in fundamental ways, because *Bt* is a widely occurring, critical product of nature that helps maintain balance across insect populations in the wild.

Contrast these resistance-driven unwanted outcomes with

increasing evidence that organic and agro-ecological practices can produce yields comparable to those produced by conventional agriculture⁶², but without the negative side effects linked to pesticides and genetically engineered crops. Indeed, organic and agro-ecological practices must be the foundation supporting sustained progress toward universal food security. Most of the world's small subsistence farmers need basic technical assistance and training, coupled with access to improved and affordable production inputs that will help restore the quality and productivity of their degraded soils.⁶³

According to the United Nations, the use of agro-ecological practices that are similar to organic methods could increase yields in the developing countries of South America, Africa, and Southeast Asia by anywhere from 86 percent to 113 percent. In other words, many subsistence-level farmers would essentially double their yields. At the same time, the U.N. found that these practices allowed farmers to decrease pesticide use by 85 percent or more.

The **Rodale Institute**, which tracks America's longest-running, side-by-side comparison of conventional and organic agriculture, has found that even where intensive, high-yield agriculture is the norm, organic production techniques can produce average yields comparable to those from conventional crops. According to their studies, in years plagued by drought conditions, organic corn has outperformed conventional crops by 31 percent. Recent results from another long running study that compares the yields and profits from conventional and organic agriculture, conducted at Iowa State University over the past 13 years, also demonstrate that organic yields are competitive with or better than conventional, with higher profits, for corn, soybeans, oats, and alfalfa.⁶⁴

So far, genetically engineered crops have increased the use of herbicides with no measurable improvement in yield or reduction in water and fertilizer use. It is clear to us that expanding and improving

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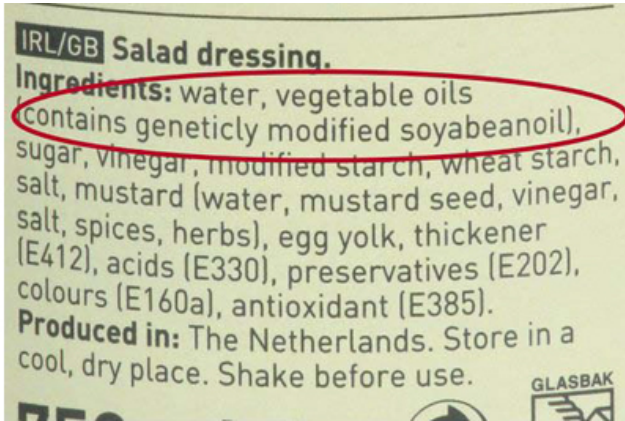
organic and agro-ecological systems of production is the way to go, especially in parts of the world suffering from malnutrition and periodic famine.⁶⁵



Chapter 4

WHAT WE CAN AND MUST DO

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The EU requires labeling on all foods that contain genetically engineered ingredients.

Before the GE experiment goes any further, we believe it's critical that each of us be allowed to choose whether we wish to be human guinea pigs: Foods produced with GE ingredients must be labeled.

While government, industry, and independent scientists engage in what looks to be a decades-long debate over risks and causation, we have a right to know what we're eating, and we deserve to be able to choose the types of foods and food production systems we want to support with our purchases.

Considering GE foods' relative new arrival and the range of risks associated with them, it's easy to see why the vast majority of people agree that GE foods should be labeled.⁶⁶ The European Union, Japan, Australia, and even China already require a label on all foods produced with GE ingredients. The time has come for Americans to catch up with the world and twenty-first-century consumers by exercising their right to know what they're eating.

One of the FDA's fundamental duties is to assure the safety of our nation's food supply. The Federal Food, Drug, and Cosmetic Act,

passed into law in 1938, authorizes the FDA to require labeling to prevent consumers from being deceived. It also charges the agency with labeling the products of novel food technologies in a way that separates them from their conventional counterparts. Clearly, this mandate applies to genetically engineered crops. Yet the FDA maintains that it doesn't need to label foods produced with GE ingredients because they don't look, smell, or taste different than conventional versions, nor do they have different nutritional content.

The idea that consumers don't need a label just because they can't detect the differences between GE and non-GE crops without a laboratory study is bad policy resting on phony science. The FDA has failed in its duty to protect the public interest.

In the summer of 2011, [Stonyfield Farm](#), the [Organic Center](#), [Amy's Kitchen](#), the [Center for Food Safety](#), [Environmental Working Group](#), [National Organic Coalition](#), [Organic Farming Research Foundation](#), [Organic Trade Association](#), [Organic Valley](#), [Union of Concerned Scientists](#), and a number of other concerned businesses and non-governmental organizations came together to identify the best way to give more people a voice in this debate. We settled on the need for a label on GE foods, and the "Just Label It" campaign was born. [Just Label It](#) launched a campaign in October 2011 to send the FDA the message that we all have a right to know whether our food was produced using GE ingredients.



The campaign has grown quickly, and at this writing it consists of over 450 partner organizations representing millions of Americans. Just Label It partners include health care, farming, environmental, and consumer organizations along with manufacturers, retailers, and more. Their partners include the American Nurses Association, Consumers Federation, breastcancer.org, Farm Aid, and Bon Appetit Management. While their individual reasons for joining this campaign may vary, what unifies these groups is the belief that it's our right to know.

The campaign has filed a legal petition with the FDA that asks the agency to require all products made using genetically engineered ingredients to be labeled. The FDA is requesting comments from the public to help inform its decision on this petition. This is our chance to be heard and to make sure that we can all have a choice about whether or not we want to consume GE foods. As of December, 2011, over 400,000 people have already written in to FDA to demand that the agency change its policy and require labels on foods that were produced with GE ingredients. See below for more information about how you can let the FDA know that it's time for a label on GE foods.

Of course, labeling is just the first step of many needed to address the damage that may already have been caused by GE crops. Questions linger about the safety, performance, and environmental impacts of these crops. Independent scientists need to take a hard look at these questions, and their findings should serve as the basis for future regulation of GE crops.

Here's What You Can Do

1. *Write to the FDA demanding labeling of all foods that contain genetically modified ingredients.*

Politicians must get the message loud and clear that their constituents have the right to know what's in their food. We must

demand labeling of foods produced with GE technology. You can add your voice to the campaign by going to JustLabelIt.org. With just a click, you can make the FDA aware of your concerns.

2. Grow and purchase organic food.

Because the USDA's official organic standards prohibit the use of GE technology, you can trust that certified organic products are grown and made without GE ingredients. All certified organic farms and food manufacturers are inspected annually and must be able to demonstrate that all aspects of the organic standard are followed.

Organic farmers and organic food companies take preventive steps to reduce the chance that GE genes will find their way into organic food through cross-pollination, the purchase of contaminated seed, mistakes in handling and mixing animal feed, or any of a dozen other ways that genetically engineered genes can move from where they are welcomed to where they are not.

3. When purchasing non-organic products, look for a non-GMO (genetically modified organism) claim backed up by testing.

If a product carries the Non-GMO Project Verified label (see the label at nongmoproject.org) the product has been tested and found to have less than 0.9 percent GMO contamination. Some companies use other testing and verification programs, many of which also guarantee that a product has very minimal or no contamination with GE ingredients.

It's important to look at the materials food companies or retailers make available about their procurement practices, segregation procedures, and testing protocols. If a company has a validated and rigorous third-party testing process, it's likely to be a trustworthy claim. None can guarantee that a product is completely free of genetically engineered ingredients, because widespread GE crop production makes contamination virtually unavoidable in some regions and under certain circumstances, especially in the case of corn, canola,

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and other crops that depend on pollen movement from one plant to another. But contamination can be kept to a very low level.

4. Avoid non-organic processed foods that are likely to be genetically engineered.

The most common GE crops in the United States are corn, soy, cotton, canola, and sugar beets. So non-organic processed foods that contain any of the following ingredients is likely to include traces of GE material:

- Corn syrup, starch, oil, meal, gluten
- Soy lecithin, protein, flour, isolate and isoflavone
- Sugar, unless it's made from cane
- Vegetable and canola oils
- Cottonseed oil

5. Spread the word! The more people learn about genetically engineered foods, the stronger public support will become for labeling them.

Tell your friends and family about the Just Label It campaign, share this book with them, and talk about your vision for the future of food.

FOOTNOTES

- 1 <http://www.monsanto.com/newsviews/Pages/glossary.aspx>. Accessed December 19, 2011.
- 2 <http://www.usgs.gov/newsroom/article.asp?ID=2909>
- 3 EPA. Table 3.6: Most Commonly Used Conventional Pesticide Active Ingredients, Agricultural Market Sector, 2007, 2005, 2003, and 2001 Estimates. From: http://www.epa.gov/opp00001/pestsales/07pestsales/usage2007_2.htm#3_6
- 4 See Table 4.1, “Impacts of Genetically Engineered Crops on Pesticide Use in the United States: The First Thirteen Years” (C. Benbrook, The Organic Center, November 2009).
- 5 E Waltz, 2010. “Glyphosate resistance threatens Roundup hegemony,” *Nature Biotechnology*, Vol. 28, No. 6: 537-538.
- 6 See <http://www.weedscience.org> for details on the emergence and spread of herbicide resistant weeds.
- 7 Kaskey, Jack. “Attack of the Superweed.” *Businessweek*, September 8, 2011. <http://www.businessweek.com/magazine/attack-of-the-superweed-09082011.html>
- 8 B. Hartzler and M. Owen. “Managing Glyphosate Failures,” July 15, 2011. <http://www.extension.iastate.edu/CropNews/2011/0715hartzler.htm>
- 9 L. Steckel, “Resistant Palmer amaranth ‘coast-to-coast’ in Tennessee,” Delta Farm Press, September 12, 2011.
- 10 For a chilling assessment of the challenges posed by resistant weeds, see J. Adler, “The Growing Menace from Superweeds,” *Scientific American*, May 2011.

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- 11 An estimated 50 million acres of treated GE corn and soybeans at an average rate of 0.4 pounds per acre.
- 12 T.E. Arbuckle et al., 2001. "An exploratory analysis of the effect of pesticide exposure on the risk of spontaneous abortion in an Ontario farm population," *Environmental Health Perspectives*, Vol. 109, No. 8: 851-857.
- 13 M. Weselak, et al., 2008. "Pre- and post-conception pesticide exposure and the risk of birth defects in an Ontario farm population," *Reproductive Toxicology*, Vol. 25, No. 4: 472-480.
- 14 V.F. Garry et al., 1996. "Pesticide applicators, biocides, and birth defects in rural Minnesota," *Environmental Health Perspectives*, Vol. 104, No. 4: 394-399.
- 15 Centers for Disease Control and Prevention, *Fourth National report on Human Exposure to Environmental Chemicals*, <http://www.cdc.gov/exposurereport/>
- 16 <http://www.ewg.org/minoritycordblood/home>
- 17 The USDA's "Pesticide Data Program" (PDP) carries out an extensive annual assessment of pesticide residues in major foods. The results show that an average serving of fresh fruits contains over three residues. Details on the average number of pesticide exposures per day via food and beverages are found in "Simplifying the Pesticide Risk Equation: The Organic Option," by C. Benbrook, The Organic Center, http://www.organic-center.org/science.pest.php?action=view&report_id=125).
- 18 *Pesticides in the Diets of Infants and Children*, National Academy of Sciences, 1993.
- 19 <http://deainfo.nci.nih.gov/advisory/pcp/annualReports/pcp09-10rpt/pcp09-10rpt.pdf>
- 20 May 5, 2010, *New York Times*, <http://www.nytimes.com/2010/05/06/opinion/06kristof.html>
- 21 <http://www.ers.usda.gov/Data/BiotechCrops/adoption.htm>
- 22 GE "Liberty Link" rice tolerant of glufosinate herbicide was approved but never planted commercially because of resistance in overseas markets and the fear of gene flow.
- 23 A plum genetically engineered to resist the plum pox virus has been deregulated (approved) by USDA, but is not likely to be commercially planted for some time. For more information, see <http://www.ars.usda.gov/is/br/plumpox/>

- 24 ISAAA (International Service for the Acquisition of Agri-Biotech Applications) Brief 42: Global Status of Commercialized Biotech/GM Crops: 2010, by Clive James.
- 25 C. Dean and R. Nuwer, "Salmon-Killing Virus Seen for the First Time in the Wild on the Pacific Coast," *New York Times*, October 17, 2011; J.E. Kim et al., 2004, "Genetic variation within and between domesticated Chinook salmon, *Oncorhynchus*
- 26 See 57 FR 22991
- 27 Demonstrating nutritional equivalency is actually not a requirement but a step companies have decided to take to, among other things, limit liability exposure.
- 28 E.g., National Research Council, 2000. *Genetically Modified Pest-Protected Plants: Science and Regulation*, National Academy Press; American Academy of Environmental Medicine, *Genetically Modified Foods*, <http://www.aemonline.org/gmopost.html>
- 29 R.J. Kremer and N.E. Means, 2009. "Glyphosate and glyphosate-resistant crop interactions with rhizosphere microorganisms," *European Journal of Agronomy*, Vol. 31; L.H.S. Zobiolo et al., 2010. "Effect of glyphosate on symbiotic N₂ fixation and nickel concentration in glyphosate-resistant soybeans," *European Journal of Agronomy*, Vol. 44: 176-180.
- 30 B. Sarkar et al., 2008. "Transgenic Bt-Cotton Affects Enzyme Activity and Nutrient Availability in a Sub-Tropical Inceptisol," *Journal of Agronomy and Crop Science*, Vol. 194:289-296.
- 31 N Casabe et al., 2007. "Ecotoxicological Assessment of the Effects of Glyphosate and Chlorpyrifos in an Argentina Soya Field," *Journal of Soils and Sediments*, <http://dx.doi.org/10.1065/jss2007.04.224>
- 32 L.H.S. Zobiolo et al., 2010. "Water use efficiency and photosynthesis of glyphosate-resistant soybean as affected by glyphosate," *Pesticide Biochemistry and Physiology*, Vol. 97: 182-193.
- 33 E.J. Rosi-Marshall et al., 2007. "Toxins in transgenic crop byproducts may affect headwater stream ecosystems," *Proceedings of the National Academy of Sciences*, Vol. 104: 16204-16208.
- 34 For details, see the National Pesticide Information Center fact sheet on Bt, <http://npic.orst.edu/factsheets/BTgen.pdf>
- 35 Aris A., Leblanc S. "Maternal and fetal exposure to pesticides associated to genetically modified foods in Eastern Townships of Quebec, Canada," *Reproductive Toxicology* (2011), doi:10.1016/j.reprotox.2011.02.004

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- 36 <http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001820/>
- 37 <http://www.cdc.gov/nchs/data/databriefs/db10.htm>
- 38 <http://thorax.bmj.com/content/62/1/91>
- 39 C. Hadley, 2006. “Food allergies on the rise?” *EMBRO Reports*, Vol. 7: 1080-1083, access at <http://www.nature.com/embor/journal/v7/n11/full/7400846.html>
- 40 <http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001820/>
- 41 A. Matthes and M. Schnitz-Eiberger, 2009. “Apple (*Malus domestica* L. Borkh.) Allergen Mal d 1: Effect of Cultivar, Cultivation System, and Storage Conditions,” *Journal of Agricultural and Food Chemistry*, Vol. 57: 10548-10553.
- 42 K. Hoffmann-Sommergruber, 2002. “Pathogenesis-related (PR) proteins identified as allergens,” *Biochemical Society Transactions*, Vol. 30, Part 6: 930-935.
- 43 V.E. Prescott et al., 2005. “Transgenic Expression of Bean α -Amylase Inhibitor in Peas Results in Altered Structure and Immunogenicity,” *Journal of Agriculture Food Chemistry*, Vol. 53: 9023-9030.
- 44 *EFSA Journal* 2010; 8(7):1700
- 45 A. Xanthis et al., 2007. “Advanced Glycosylation End Products and Nutrition—A Possible Relation with Diabetic Atherosclerosis and How to Prevent It,” *Journal of Food Science*, Vol. 72, No. 8: R125-R129.
- 46 This historic statement remains an official “Anonymous public comment” in the docket – “EPA-HQ-OPP-2008-0836.
- 47 Pollack, Andrew. “Crop Scientists Say Biotechnology Seed Companies are Thwarting Research” *New York Times*, February 20, 2009. <http://www.nytimes.com/2009/02/20/business/20crop.html?scp=3&sq=genetically+modified&st=nyt>
- 48 Rosi-Marshall, E.J., et al., *Proceedings of the National Academy of Sciences*, Vol. 104, 16204-16208, 2007.
- 49 Fedoroff, Nina. “Engineered Food for All.” *New York Times*, August 18, 2011. <http://www.nytimes.com/2011/08/19/opinion/genetically-engineered-food-for-all.html>
- 50 Fedoroff, Nina. “Engineered Food for All.” *New York Times*, August 18, 2011. <http://www.nytimes.com/2011/08/19/opinion/genetically-engineered-food-for-all.html>
- 51 Clay, Jason. “Free the Footprint of Food.” *Nature*, Vol. 475, July 21, 2011: 287-289.

- 52 U.N. General Assembly Report submitted by Olivier De Schutter, the Special Rapporteur on the right to food. December 20, 2010.
- 53 Guiran-Sherman, Doug. "Failure to Yield." Union of Concerned Scientists, April 2009. http://www.ucsusa.org/food_and_agriculture/science_and_impacts/science/failure-to-yield.html
- 54 Kaskey, Jack. "Attack of the Superweed," *Businessweek*, September 8, 2011. <http://www.businessweek.com/magazine/attack-of-the-superweed-09082011.html>
- 55 Gassmann, Aaron J. , Jennifer L. Petzold-Maxwell, Ryan S. Keweshan, Mike W. Dunbar "Field-Evolved Resistance to Bt Maize by Western Corn Rootworm" PLoS ONE 6(7):e22629. doi:10.1371/journal.pone.0022629. July 2011.
- 56 Gurian-Sherman, Doug. "Failure to Yield." Union of Concerned Scientists, April 2009. http://www.ucsusa.org/food_and_agriculture/science_and_impacts/science/failure-to-yield.html
- 57 Gassmann, Aaron J. , Petzold-Maxwell, Jennifer L., Keweshan, Ryan S., and Dunbar, Mike W. "Field-Evolved Resistance to Bt Maize by Western Corn Rootworm" PLoS ONE 6(7):e22629. doi:10.1371/journal.pone.0022629. July 2011.
- 58 International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD), 2009. "Executive Summary of the Synthesis Report."
- 59 For dozens of examples, see D. Nierenberg and B. Halweil, 2011. *State of the World: Innovations that Nourish the Planet*, Worldwatch Institute, W.W. Norton & Company.
- 60 <http://www.leopold.iastate.edu/news/11-15-2011/long-running-experiment>
- 61 J. P. Reganold, D. Jackson-Smith, S. S. Batie, R. R. Harwood, J. L. Kornegay, D. Bucks, C. B. Flora, J. C. Hanson, W. A. Jury, D. Meyer, A. Schumacher, Jr., H. Sehmsdorf, C. Shennan, L. A. Thrupp, P. Willis. "Transforming U.S. Agriculture." *Science*, Vol. 332, May 6, 2011: 670-671.
- 62 A Quest Research Group poll in June 2011 found that 88% of consumers agreed that GE foods should be labeled. Various other private and public polls support this finding.

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dramatic impact of weed resistance on overall per acre herbicide use.

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