Biotech and Baby Food

By Henry I. Miller and Gregory Conko

Warnings about one societal danger or another often portray children as the likeliest or most susceptible victims. As is the case with so many other public health false alarms, the attack on the new biotechnology — also known as bioengineering, gene splicing, or genetic engineering — is less about real concern for children's health than about environmental activists' willingness to exploit children's issues for their own benefit. Biotechnology has been the target of scare campaigns since the technique was first demonstrated in 1973. Activists, like Jeremy Rifkin of the Foundation on Economic Trends, have been warning against the supposed dangers of biotechnology for three decades, calling it "the most radical, uncontrolled experiment we've ever seen" and even likening it to "Nazi eugenics." Others have claimed that gene-spliced crop plants are "worse than nuclear weapons or radioactive wastes." Fortunately, the American public has not taken such arguments seriously.

Henry I. Miller, M.D. is a research fellow at the Hoover Institution, Stanford University, and author of Policy Controversy in Biotechnology: An Insider's View *(R.G. Landes, 1997). Gregory Conko is director of food safety policy at the Competitive Enterprise Institute.*

The first biotechnology-derived medical treatment, human insulin, was commercialized in 1982, and the first biotech plant in 1994. During the past two decades, thousands of new medicines, foods, and industrial products have been produced with the aid of modern biotechnology and sold to doctors, farmers, manufacturers, and consumers. So powerful is the technology that literally tens of millions of lives worldwide have been protected, enriched, and even lengthened due entirely to these techniques. But so subtle and precise are the production changes generated by the technology that very few people recognize how widely biotechnology figures in everyday life.

Indeed, it was not until the late 1990s that activist scare campaigns began to gain traction. The earliest successes were in several Western European countries, where environmentalists capitalized on recent food scares — primarily the concern about Bovine Spongiform Encephalopathy, or "Mad Cow Disease" — to frighten consumers about what seemed to be another mysterious threat in the food supply. But no similarly frightening affliction has beset the U.S. food supply in decades, so Americans have not been so easily scared away from the technology. However, environmental activists may have found the right approach for their U.S. audience in the time-tested tactic of capitalizing on parents' concern about the health of their children.

Tens of millions of lives worldwide have been protected, enriched, and lengthened.

In 1998, the environmental activist group Greenpeace began a campaign aimed at frightening baby-food producers away from using biotech-derived ingredients in their products. Prior efforts had failed to scare Americans away from agricultural applications of biotechnology, but Greenpeace had significantly better luck with this new approach. The ploy had worked wonders in Europe earlier that year as part of a broader campaign. In that case, Greenpeace activists simply asked, in a letter to executives of the Swiss baby-food line Galactina, whether their products contained biotech ingredients. Galactina's parent company, the pharmaceutical giant Novartis, buckled under even that minimal pressure literally overnight, promising to remove certain existing products from grocery store shelves and to reject biotechnology in future production. Naturally, when Greenpeace targeted Gerber Foods, the U.S. baby-food brand also owned by Novartis, it expected a similar result — and got it.

In May 1999, Greenpeace activist Charles Margulis faxed a letter to Gerber headquarters in Freemont, Michigan, demanding to know whether Gerber used gene-spliced products in its baby food and inquiring about any steps Gerber was taking to make sure that no gene-spliced ingredients were used. Earlier that year, a spurious environmental issue had been raised when the journal *Nature* published a brief report suggesting that certain gene-

spliced corn varieties could have a negative impact on Monarch butterflies. The report had been picked up and grossly exaggerated by the popular media and, in any case, was later discredited. No substantial public concern about the safety of biotechnology for humans was elicited, but the damage was done. Gerber had learned that even unwarranted scares could command substantial media attention, and by July, the company caved in to Greenpeace's threat.

Gerber representatives tried to make clear that the company did not believe biotechnology to be dangerous in any way. But competition in the food industry is intense, and profit margins tend to be very small. Thus, were it to embrace biotechnology, Gerber believed it could suffer from the kind of negative publicity that would likely result from a Greenpeace-led campaign against the company. Gerber announced plans not only to drop gene-spliced ingredients from its products, but also to try to use only organic ingredients in the future.

Gerber learned that even unwarranted scares could command substantial media attention.

Unaware of the successful campaign against Gerber's Swiss counterpart, Galactina, American supporters of biotechnology were shocked by the company's announcement that it would relinquish biotechnology. After all, Novartis, parent company to both product lines, was also one of the world's largest producers of gene-spliced plant seeds, so the decision by two Novartis divisions to forgo one of their parent company's most important products cast a pall over the entire biotechnology industry. Almost immediately, two other baby-food producers, Pittsburgh-based H.J. Heinz Company and Healthy Time Natural Foods of Poway, California, announced that they too would be making similar changes in their products, and another major baby-food producer, St. Louis-based Beech-Nut Nutrition Corporation, announced that it too was eschewing biotech ingredients.

The damage this campaign has done to food producers' confidence in their decisions to use biotechnology-derived ingredients, versus going "biotech free," has been tremendous. Soon after, Pepsico-owned Frito Lay, one of the largest U.S. manufacturers of snack foods, told its corn suppliers that it would no longer purchase gene-spliced corn varieties for use in corn or tortilla chips. And both McDonald's and Burger King informed their suppliers that they would not purchase gene-spliced potato varieties for making french fries. Even alcoholic beverage producers Seagram's, Kirin, and Sapporo have sworn off gene-spliced varieties for their products. Thus, environmental activists have begun to accomplish indirectly what they could not achieve by targeting consumers directly.

These decisions are, in the long run, anti-consumer. They reduce con-

sumer choice and possibly even the safety of the food products. Biotechnology enhances product safety not only by its greater precision, but also by exploiting the subtleties of plant pathology. A good example is a gene-spliced corn variety engineered to kill certain insect pests (which can also minimally affect some non-pest insects, including butterflies), but which is harmless to humans and other mammals. As it fends off the insects, the gene-spliced corn also reduces the levels of Fusarium, a toxic fungus often carried into the plants by the pests. This, in turn, reduces the levels of fumonisin, a potent and dangerous fungal toxin that can lead to fatal diseases in horses and swine that ingest infected corn and can also cause esophageal cancer in humans. Thus, using the gene-spliced corn for food processing lowers the probability that harmful levels of fumonisin will be found in the harvested kernels.

Fortunately, a broad-scale disavowal of biotechnology by the food industry has not ensued, but an important, natural ally of the biotechnology industry has been publicly neutralized. Caught between the threats of activists and the desire to use superior technology to enhance their products, major food producers are clearly reluctant to put their brand reputation at risk — especially in the face of a campaign aimed at worrying parents about the safety of their children. They are only too aware of the lengths to which activists will go in the name of protest: They have destroyed crops undergoing field trials, vandalized laboratories and greenhouses, and even set fire to research offices at Michigan State University.

Many branded food products have developed a long-standing and well-deserved reputation for quality and safety. But it's also that reputation that should make the food industry inclined to defend gene-spliced agricultural products. The benefits of biotechnology for food processors, in terms of reduced prices and better product attributes, can be substantial. More important, however, food biotechnology has the potential to make foods safer and more nutritious. Thus, by scaring food processors away from food biotechnology, the anti-biotech "kid campaign" could well have a real and negative effect on the future of this important technology. Its loss could actually make our children worse off, not better.

How safe is biotechnology?

ALTHOUGH MOST AMERICANS have not succumbed to the ideological scare-mongering campaign against biotechnology, they cannot avoid hearing over and over about the supposed threats to children's health. Increasingly, some Americans are beginning to view gene-spliced foods with more than a little skepticism. Of course, those who are critical of biotechnology are often unaware of an important, fundamental point: The modification of organisms at the basic genetic level is not new, and consumers, farmers, and industries all have extensive — and positive —

experience with it. Even the term "biotechnology" was once used in a much broader sense, to describe any application of biological organisms to technical or industrial processes. A primitive form of food biotechnology dates back at least to 6000 BC when the Babylonians used microorganisms in fermentation to brew alcoholic beverages. Only in recent years has biotechnology come to connote only the most sophisticated methods for modifying organisms at the genetic level.

During the course of the twentieth century, a better understanding of genes and cell biology added to the improvement of all manner of organisms. An excellent example is the genetic modification of *Penicillium chrysogenum*, the mold that produces penicillin. Using a variety of techniques, the mold has been altered to produce more and more penicillin, and yields have increased more than a hundredfold in the past five decades. Similarly, agricultural crops have been genetically improved with astonishing success with both "natural" and "unnatural" breeding techniques. These applications of older biotechnologies represent scientific, technological, commercial, and humanitarian successes of monumental proportions. The "conventional" genetic modification of wheat plants was recognized in 1970 when the Nobel Peace Prize was awarded to Dr. Norman Borlaug, the "Father of the Green Revolution."

However, the techniques used for these earlier successes were relatively crude and recently have been supplemented, and in many cases supplanted, by modern biotechnology. The techniques described by practitioners as gene splicing, genetic engineering, or recombinant DNA engineering use a variety of tools to identify single genes from one organism, isolate and remove them from the surrounding DNA, and then insert them into the DNA strands of other organisms. Because the DNA in every living organism is made up of the same basic chemicals — and because DNA works in essentially the same way whether it's in a bacterium, a plant, or an animal — a gene can be moved from one organism to another and still produce the same trait. And the products of modern biotechnology can be used for a variety of purposes — including modified bacteria for cleaning up oil spills; a weakened virus used as a vaccine; a protein, such as insulin, used to treat diabetics; or a crop plant modified to need less pesticides or to be more nutritious.

Dozens of scientific bodies, including the UK's Royal Society, the U.S. National Academy of Sciences, the World Health Organization, and the American Medical Association, have studied modern biotechnology and gene-spliced organisms and arrived at remarkably congruent conclusions about their safety:

- Modern genetic modification techniques are an extension, or refinement, of earlier, far less precise ones;
- Simply adding genes to plants or microorganisms does not make them less safe either for the environment or for humans;

- The risks associated with gene-spliced organisms are the same in kind as those associated with conventionally modified organisms (and in both cases are usually extremely low); and
- Regulation of the products of genetic modification should be based upon the risk-related characteristics of individual products, regardless of whether newer techniques are used in their development.

Thus, the primary thing that has changed since the introduction of gene-splicing methods in the early 1970s is the *technology* of biotechnology. The new technology, however, is more precise and predictable than its predecessors and yields better-characterized and more predictable products. There are already more than 100 gene-spliced medicines on the market and more than 300 more in clinical development. Marketed products include human insulin, used daily by millions of American diabetics; tissue plasminogen activator, a protein that dissolves the blood clots that cause heart attacks and strokes; human growth hormone, used to treat children with hormonal deficiency; erythropoietin, which stimulates the growth of red blood cells in certain patients suffering from anemia and is especially beneficial to cancer patients who have undergone chemotherapy; and several interferons, proteins used to treat a variety of maladies from multiple sclerosis to viral infections and cancer.

This reality of current therapeutics, along with the vast potential of biotechnology to produce new and better medicines, presents such a powerful argument for the medicinal use of biotechnology that it has been difficult for anti-technology activists to challenge it. Scare campaigns have instead typically focused on attacking agricultural applications of biotechnology. But gene-spliced plants have also shown many important benefits for both farmers and consumers, as well as for the environment.

Dozens of gene-spliced crop and garden plants now on the market have been genetically improved with a range of new traits, including resistance to insect pests and plant diseases. Gene-spliced varieties of insect-resistant corn and cotton have been modified to produce a protein that is toxic to certain chewing insects but not to birds, fish, or mammals, including humans. In turn, they require fewer applications of synthetic pesticides and generate higher yields. Gene-spliced varieties of soybean and canola that are resistant to one or another herbicide allow farmers to spray less and still control weeds effectively. Because this eliminates the need for mechanical cultivation to remove weeds, herbicide-tolerant crop plants protect topsoil from eroding easily, which has been a major agricultural and environmental concern for decades. And biotech-derived growth hormones for livestock, like cows and pigs, can help farmers produce more meat and milk at a lower price and with less nitrogen and phosphorous waste from the animals.

One such hormone, recombinant bovine somatotropin (rbST), or bovine growth hormone, has been a target of activists for nearly two decades. The Food and Drug Administration approved the product in 1993 to boost milk

production in cows after more than 10 years of intensive scrutiny (although, years earlier, the agency had approved the analogous human hormone for use in growth-hormone-deficient children after a mere 18 months of review). But scaremongers have often claimed that administration of the hormone to cows was potentially hazardous to consumers of the milk — causing, for example, immune deficiencies in children. One activist, Samuel Epstein of the Cancer Prevention Coalition, has charged that drinking milk from cows given rbST will cause an increase in childhood cancers — even though milk from treated cows is chemically indistinguishable from other milk.

But scientific evidence doesn't seem to matter. Activists have targeted schools, day care centers, and even the coffee retail chain Starbucks for boycotts and petition campaigns calling for the end of rbST use, in spite of endorsements for the product by such esteemed scientific bodies as the American Medical Association, the American Cancer Society, the National Institutes of Health, and the United Nations World Health Organization and Food and Agricultural Organization.

The adoption of rbST by U.S. farmers in the face of such antagonism has been remarkable. But it demonstrates an important correlation that exists between citizens' well-being and government policies that encourage product innovation. Farmers use rbST, which increases the productivity of their cows roughly 10 percent to 25 percent. This, in turn, enables them to produce the same amount of milk with fewer expenditures, making the farmers better off and reducing the retail price for consumers. Ultimately, if government agencies were to keep the regulation of research and development only to the level that is necessary and sufficient, the quest for profits would stimulate researchers' and industry's interest in making more products like rbST.

Health risks for children?

DESPITE THE OVERWHELMING scientific consensus that biotechnology methods pose no inherent risks, critics still argue that splicing genes into plants can cause all sorts of human health risks, including the addition of new phytochemical toxins or allergens into the food supply. The allergy issue is of special concern when children are involved, because children tend to be more sensitive to allergens than adults. According to the National Institutes of Health, approximately 5 percent to 8 percent of children have a true allergy to certain types of foods, but only 1 percent to 2 percent of adults do. So, if biotechnology really did increase the risk of introducing new allergens into the food supply, this might pose a genuine children's health issue. But is this a real possibility?

Food allergies are a reaction of the body's immune system to a substance or an ingredient in a food, usually a protein. And, because the function of most genes is to provide the cellular blueprint for making proteins, it has

been easy for activists to convince the uninformed that a real children's health scare is imminent. But the issue is not so simple. Both conventional and biotech plant breeding involves the introduction of new genes into established crop plants. Thus, they both pose a risk of introducing potentially harmful proteins and other substances into the food supply, some of which could be allergens or toxins. But it is important to remember that the risk for both types of breeding is generally quite small. Furthermore, the level of risk an individual plant variety will pose — either to human health or to the environment — has nothing to do with how it was developed; it has solely to do with the characteristics of the plant that is being modified, the specific gene or genes that are added, and the local environment into which it is being introduced. In short, the fact that biotechnology was used to introduce a new gene into a crop plant has no bearing on whether or not new allergy issues could arise. Indeed, with biotechnology, breeders are actually less likely to introduce new allergens into the food supply. Why?

The level of risk an individual plant will pose has nothing to do with how it was developed.

Conventional plant breeding involves an essentially random mix of literally tens of thousands of genes from two or more parent plants — any one of which may never before have been part of the human food supply. Thus, plant breeders generally have little knowledge about which genes combine to create new crop varieties, which gene products are expressed (and at what levels), or which traits may be generated or altered. Dozens of new plant varieties produced through imprecise hybridization and other traditional methods of genetic improvement enter the marketplace each year without any scientific review or special labeling. Many such products are from "wide crosses," hybridizations in which large, sometimes huge, numbers of genes are moved from one species or one genus to another to create a plant variety that does not and cannot exist in nature. For example, *Triticum agropyrotriticum* is a relatively new man-made "species" that resulted from combining genes from bread wheat and a grass sometimes called quackgrass or couchgrass. Possessing all the chromosomes of wheat and one extra whole genome from the quackgrass, *T. agropyrotriticum* has been independently produced in the former Soviet Union, Canada, the United States, France, Germany, and China and is grown for both animal feed and human food. One might envision various problems arising from such a genetic construction, which introduces tens of thousands of foreign genes into an established plant variety. For example, the new genes could increase the invasiveness (or weediness) of the plant in fields, or proteins derived from the quackgrass genes could be toxic or allergenic to consumers. However, neither regulators nor activists have evinced any concern about these possibilities. Instead of focusing regu-

latory attention on such risk-related issues, they have concentrated solely on gene-spliced plants, about which plant biologists and breeders invariably know considerably more. They know, for example, exactly which new genes are being added into an existing plant line, and they know what proteins those genes will help create. Often they even know the precise sequence of the DNA segments that have been inserted.

An analysis of gene-splicing techniques published by the U.S. National Research Council in 1989 concluded:

> [Gene-splicing] methodology makes it possible to introduce pieces of DNA, consisting of either single or multiple genes, that can be defined in function and even in nucleotide sequence. With classical techniques of gene transfer, a variable number of genes can be transferred, the number depending on the mechanism of transfer; but predicting the precise number or the traits that have been transferred is difficult, and we cannot always predict the [characteristics] that will result. With organisms modified by molecular methods, we are in a better, if not perfect, position to predict the [characteristics].

Why, then, are genetic constructions crafted with the older, less precise techniques exempt from regulation from the dirt to the dinner plate? Why don't regulatory regimes require that new genetic variants made with older techniques be evaluated for increased weediness or invasiveness, or for new allergens that could show up in food? The answer is based on millennia of experience with genetically improved (but pre-gene splicing) crop plants: Even the use of relatively crude and unpredictable genetic techniques for the improvement of crops and microorganisms poses minimal risk to human health or the environment. Regulators in the United States and many other countries have found that post-marketing regulation of food largely through surveillance of the marketplace is sufficient to assure food safety. Equally important, it permits plant breeders, food processors, and manufacturers to offer consumers a vast array of constantly improving, varied, tasty, and inexpensive foods.

Paradoxically, only the more precisely crafted, gene-spliced crops are exhaustively, repeatedly, and expensively reviewed before they can enter the field or food supply. If those supposedly concerned about risk were crafting regulatory approaches logically, the balance of scientific certainty and uncertainty would dictate that greater precaution apply not to gene splicing but to the cruder, less precise, less predictable "conventional" forms of genetic modification. Instead, regulators and their supporters — including anti-biotech activists — have chosen to set the burden of proof far higher for the products of gene splicing.

Potentially even more important, one of the most noteworthy potential advantages of biotechnology is actually to eliminate existing allergens from foods like peanuts, wheat, and milk by "silencing," or turning off, the genes that generate allergenic proteins. Professor Steve Taylor, a noted allergen

researcher at the University of Nebraska, says that, "in the long term, we will have foods that are less hazardous because biotechnology will have eliminated or diminished their allergenicity."

Safer and healthier kids

Aside from the very promising possibility of making "allergy free" foods, there are plenty of other important health benefits that food biotechnology holds in store. One good example is the addition of vitamins, minerals, and essential amino acids into staples, such as grain crops, that have little micronutrient value. Another is the ongoing research into developing vegetables with higher levels of potentially beneficial micronutrients. Varieties of soybean and canola, which have been modified with modern biotechnology to produce healthier cooking oils with less saturated fat, are even now being grown on tens of thousands of acres in the United States and Canada.

Even more important are the nutritional benefits gene-spliced plants could deliver to people in less developed nations. For example, the diet of more than 200 million children worldwide includes inadequate levels of many important micronutrients such as vitamin A. In Asia, this is often caused by the weaning of poor children on little more than rice gruel. Deficiency in this single micronutrient can result in impaired intellectual development, blindness, and even death; each year, approximately 2 million children die from a severe lack of vitamin A. Fortunately, a substantial amount of research into improving the nutritional value of staple crops is well underway. Perhaps the most promising recent advance in this area is the development of a rice variety that has been genetically enhanced to add beta carotene into the edible grains, which is then converted in the human body to vitamin A. It is estimated that by boosting the availability of vitamin A in developing-world diets, this variety, called Golden Rice, could help prevent as many as a million deaths per year and eliminate numerous other health problems. A similar modification to increase iron content is also under active investigation.

And there are many other ways in which biotechnology can help poor women and children, who perform much of the daily farm work in less developed countries. One approach is to enhance the ability of many kinds of crop plants to grow in poor soils, a problem that reduces cereal crop productivity over vast areas of the earth, but primarily in the poorer nations of the tropical zone. Adding genes to rice and corn that enable the plants to tolerate high concentrations of aluminum in the soil is the goal of a team of scientists in Mexico. Other researchers, at the University of Toronto and the University of California at Davis, are creating crop varieties that can be irrigated with poor quality, brackish water. And there are many similar examples of crop modifications, such as improving the ability of plants to grow in alkaline, iron-poor soil, that could have direct and

substantial benefits for poor farmers.

Gene splicing can also address the monumental need in less developed countries for both new childhood vaccines and cheaper versions of existing vaccines. The latter can be achieved by lowering production costs and/or reducing the cost of immunization — for example, by eliminating the need for refrigeration or developing oral vaccines that do not require a needle and syringe. Gene-spliced plants are already being developed that contain edible vaccines against many infectious scourges rampant in developing nations, including hepatitis B and various diarrheal diseases.

Even currently marketed gene-spliced products, such as the pest-resistant cotton so popular in the United States, have permitted farmers in less developed nations such as South Africa and China to reduce their dependence on synthetic pesticides. Cotton farming uses very large doses of pesticides, and in less developed nations those pesticides are typically sprayed on crops by hand. This is often labor-intensive and expensive. In addition, in China, for example, some 400 to 500 farm workers die every year from acute pesticide poisoning, and approximately 50,000, many of them women and children, have suffered serious illnesses since 1987, attributed to on-farm contact with pesticides. But the introduction of gene-spliced, pest-resistant cotton varieties in China has reduced pesticide poisonings by nearly 80 percent among growers of the biotech varieties.

Gene splicing can address the need in less developed countries for new and cheaper childhood vaccines.

While plant geneticists are working to engineer many useful traits into crop plants, some of the benefits of biotechnology will be wholly unanticipated. Consider again the pest-resistant corn example described above. That gene-spliced variety has been found to reduce considerably the levels of harmful fumonisin toxins in harvested grains, an important, although poorly appreciated, health benefit. In industrialized countries like the United States and Canada, strict processing standards and sophisticated testing methods keep the amounts of fumonisin in food well below dangerous levels. But in poorer regions of the world, where corn is usually grown in small plots by single families who consume most or all of the produce, such quality control is nonexistent.

In 1990 and 1991, the number of babies born in and around the south Texas town of Brownsville with an extraordinarily rare condition called anencephaly — in which the brain of the newborn infant is stunted or missing — rose to double the normal rate, then returned to normal the following year. The condition was found primarily among the children of poor Mexican immigrant mothers, who tend to consume very large amounts of corn every day in tortillas alone. After initially suspecting industrial pollu-

tants as the culprit, the Texas Department of Health now blames the near-epidemic on exceptionally high fumonisin levels in corn caused by a multi-year drought in northern Mexico and the southwestern United States. Similar examples undoubtedly occur without documentation throughout the world. But biotech products like pest-resistant corn could be an important way to reduce the incidence of such heart-rending problems.

Even such desperately needed biotech products as these do not escape the activist scare campaigns. When the United States Agency for International Development sent a shipment of corn and soy meal to aid the victims of a cyclone in the Indian province of Orissa, anti-technology activists took samples of the food to test whether or not it contained gene-spliced varieties. When they found that it did, Vandana Shiva, director of the New Delhi-based Research Foundation for Science, Technology and Ecology, an environmental activist group, argued, "The U.S. has been using the Orissa victims as guinea pigs for [gene-spliced] products" — even though these were the very same biotech corn and soy varieties that U.S. consumers had been eating for years.

To biotechnology critics like the *New York Times Magazine* food journalist Michael Pollan, Golden Rice is just a "Great Yellow Hype" — a ploy by multinational biotechnology corporations to get the world hooked on gene splicing. Never mind that the research was funded primarily by the New York-based Rockefeller Foundation, which has promised to make the rice available to developing-world farmers at little or no cost. Ismail Serageldin, director of the UN-sponsored Consultative Group on International Agricultural Research, asks biotech opponents, "Do you want 2 to 3 million children a year to go blind and 1 million to die of vitamin A deficiency, just because you object to the way golden rice was created?" Apparently, in their opposition to biotechnology, critics find it more important to use children as a symbol than actually to make the world a safer or healthier place for kids.

Bitter fruits

In spite of significant and real — not merely conjectural — benefits of gene-spliced foods, the anti-biotechnology "kid campaign" has borne fruit for environmentalists in a way that other forms of activism could not. Whether the campaign will ever succeed in frightening large numbers of American consumers away from biotech is yet to be seen. It is, however, likely to exacerbate the tendency of governments to over-regulate modern genetic technologies. The activists need not scare consumers or food processors completely to succeed in destroying biotechnology. They could be successful simply by weakening public support just enough to provoke unnecessary and poorly conceived legislation or regulation.

Already, most regulatory agencies have treated gene-spliced foods and crop plants in a discriminatory, unnecessarily burdensome way. They have

imposed costly and time-consuming requirements that could not possibly be met for conventionally bred plants. Agricultural biotechnology research and development have become so expensive that research on developing countries' subsistence crops — millet, cassava, sorghum, yams, and the like — has almost evaporated. Research on tropical rice varieties has continued only courtesy of huge subsidies from governments and charities, such as the Rockefeller Foundation. Adding still more regulation could turn gene splicing into a kind of boutique technology that is applied primarily to high-value products that are affordable only by the affluent. The biggest losers would be the inhabitants of less developed countries and lower-income consumers everywhere else. Thus, the safe and effective products of this technology, which hold so much promise for improving the health of children, could be stripped from their hands by a campaign perversely designed to exploit them for political gain.

Peacekeepers, Inc.

By P.W. Singer

Violence breaks out in a small African state. The local government collapses and reports emerge that civilians are being massacred by the tens of thousands. Refugees stream out in pitiable columns. As scenes reminiscent of the Rwanda genocide are played out on the world's television screens once again, pressure mounts to do something. The U.N.'s calls for action fall on deaf ears. In the U.S., the leadership remains busy with the war on terrorism and Iraq and decides that the political risks of doing nothing are far lower than the risks of losing any American soldiers' lives in what is essentially a mission of charity. Other nations follow its lead, and none are willing to risk their own troops. As the international community dithers, innocent men, women, and children die by the hour.

It is at this point that a private company steps forward with a novel offer. Using its own hired troops, the firm will establish protected safe havens where civilians can take refuge and receive assistance from international aid agencies. Thousands of lives might be saved. All the company asks is a check for $150 million.

What would the international community do when faced with such a choice? Would it allow peacekeeping to become a profit-making exercise? Or would it choose to spurn the firm's offer, but at the risk of lives on the ground? It is certainly a fascinating dilemma, but one that sounds almost too implausible to consider seriously. It is not.

Peter Warren Singer is an Olin fellow in the Foreign Policy Studies Program at the Brookings Institution and coordinator of the Brookings Project on U.S. Policy Towards the Islamic World. He is the author of Corporate Warriors *(Cornell University Press, 2003).*