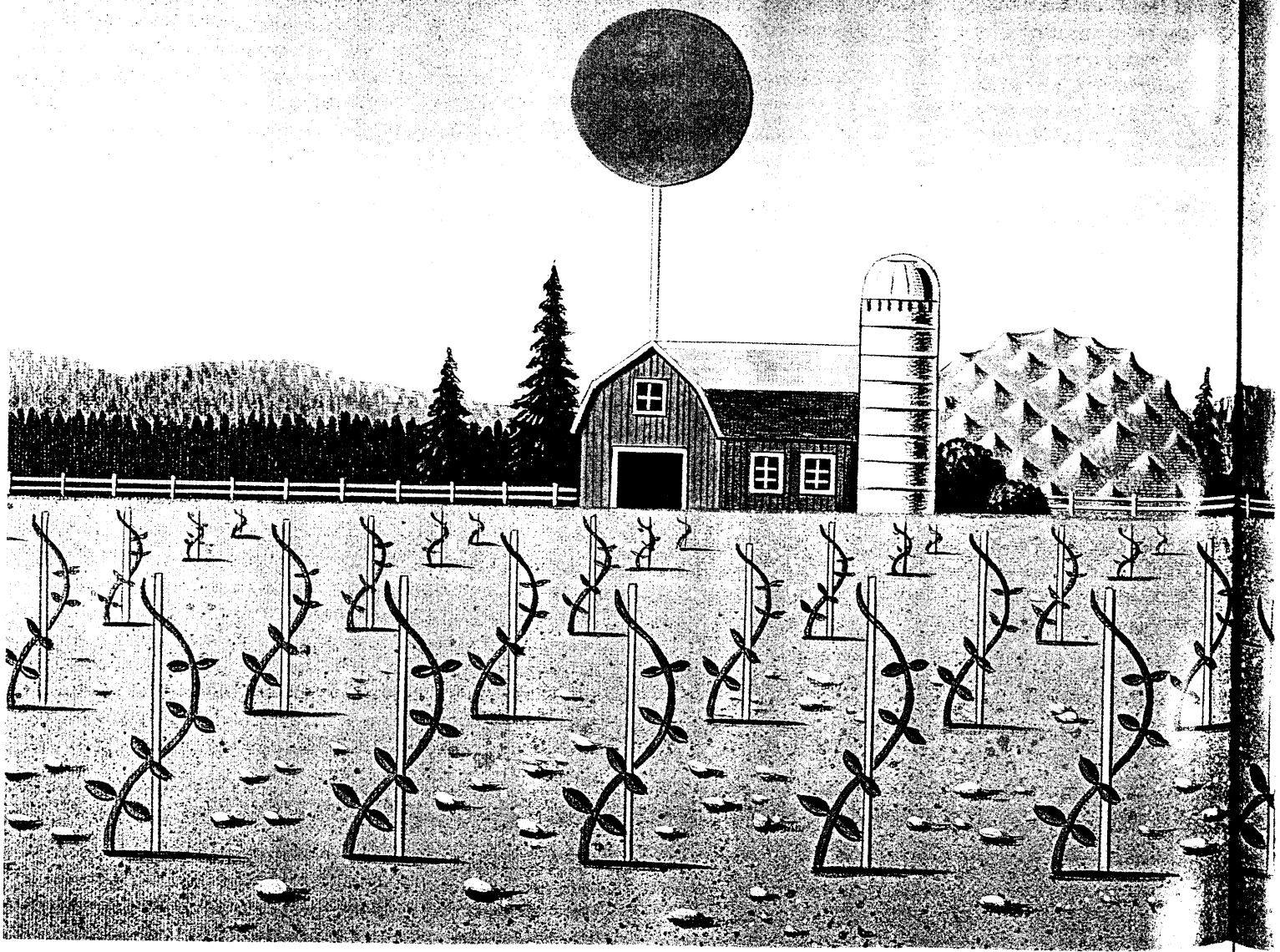
THE COMING OF THE HIGH-TECH HARVEST

From tomatoes that won't rot to potatoes that bite back, the brave new world of genetic farming is full of promise, rife with controversy, and, critics charge, barely regulated.

BY PAMELA WEINTRAUB ~ ILLUSTRATIONS BY JAMES MARSH



Driving a pickup through the flat, fertile plains of Yolo County, California, Charlie Rominger knows every curve of the road as it meanders between an endless grid of wheat fields and the peaks of the towering Coast Range. He also knows the ancient history of every square inch of land. Gesturing toward what looks like a crazy quilt of grass, he explains the whole evolution of a field—Sara wheat growing on top of lentils on top of peas. Getting out of the truck, Rominger, 37, runs his hand through the dirt and pulls out a square, rusted nail. "A souvenir," he comments, "from the past."

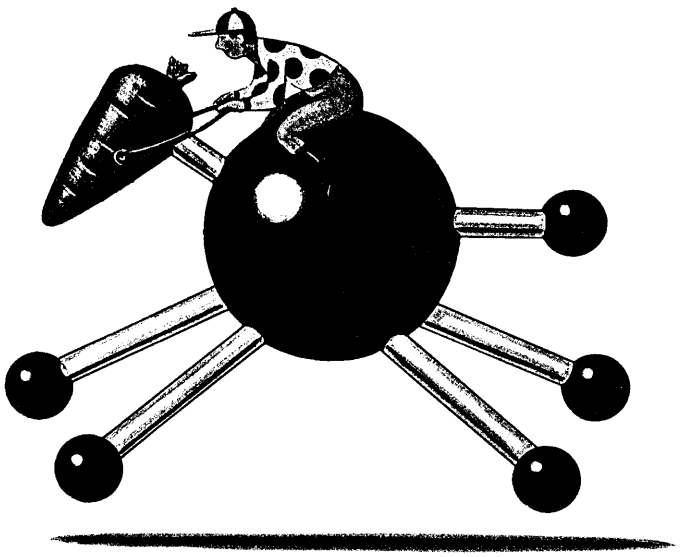
It was back in the 1870s that Rominger's great-great-grandfather bought some acreage in the great Central Valley and launched the family farm. Since then, the rich and fertile earth has done well by the Romingers: Alfalfa and wheat, sugar beets and tomatoes, have helped to make their ranch, now 5,000 acres, one of the more successful in the state.

But the family's success is not just due to a single smart investment. Rominger, his two brothers, and their dad all hold agriculture degrees from the University of California, Davis. These sophisticated growers, as farmers in these parts are called, run their land with the help of computers and scores of publications on every aspect of farming, from the microbial environment to soil erosion. They also work hand in hand with scientists, providing plots where some of the latest crop varieties are tested for the very first time. The Romingers have become community leaders—in land-use issues and in new technologies. When something flies on the Rominger farm, there's a good chance it will be adopted elsewhere as well.

These days, the forward-thinking Romingers have their eyes on what some people call the most explosive advance in farming since the dawn of the agricultural age. This controversial new tool—biotechnology—is now being used in labs around the world to endow crop plants with genes from mammals, bacteria, and of course, a lot of other plants.

Biotech advocates say the new technology will increase the Romingers' wheat yield, sweeten the taste of their tomatoes, and protect their produce from disease.

Critics fear the technology could backfire: Crops transformed to resist a new generation of less toxic herbicides could discourage the family from tapping organic weed-control methods, continuing their reliance on chemicals. Crops engineered to fend off insects could become useless in a decade or less, when the bugs become immune. The Romingers themselves have a wait-and-see attitude about actually implementing the technology. But always in the market for another smart investment, they've bought some stock in the company down the road.



Calgene sits about 15 miles as the crow flies from the Rominger ranch, in the college town of Davis, just west of Sacramento. Roger Salquist, Calgene's tall and slightly on-edge CEO, pursues his vision of the future without the benefit of rolling fields or a mountain view. Instead, the company operates from a squat green-and-gray concrete building, a structure with all the prefabricated elegance of a box. In the back of this box, in a winding maze of laboratories, 65 scientists labor on crops for the 21st century—Calgene's new tomato, for instance, into which a gene was inserted that blocks the enzyme that causes tomatoes to rot. Dubbed the Flavr Savr, it resists rotting for some 10 days more than normal tomatoes. As Salquist explains, you don't have to pick them while not yet ripe to buy extra time for shipping. Instead, Flavr Savrs are left on the vine until the last possible moment, turning red and collecting all the sugars and acids that give tomatoes their rich and pungent taste.

> These "gene-jockeys," as one critic refers to them, "get a thrill out of creating life." She knows a man in California who talks about "building potatoes."

The Flavr Savr is just one of Calgene's biotech products. About a mile from corporate headquarters stand nine domed farms, sealed and spectral in the Central Valley sun. These are the Calgene greenhouses. In one, reed-thin stalks of engineered canola produce seeds with oil especially low in saturated fat. In another, soft tufts of cotton withstand the onslaught of Bromoxynil, a potent herbicide that would otherwise poison the cotton as well as the weed it was meant to destroy.

Calgene is not alone. The Monsanto Company, in St. Louis, has poured hundreds of millions of dollars into agricultural biotechnology over the past decade. The company's new cotton, for instance, contains DNA from rod-shaped bacteria—called *Bacillus thuringiensis*, or B.t.—that produce protein crystals lethal to caterpillars. B.t. crystals churned out by the cotton hunker silently within until a bollworm takes a bite. Then the crystals go to work, perforating the caterpillar's stomach. The same bacteria are being engi-

neered into potatoes and corn. Monsanto and a handful of other companies are creating crops resistant to their own herbicides—an altered harvest they claim will lower farmers' dependence on chemicals by enabling them to tap more environmentally sound and more effective herbicide brands. Scientists at institutes from UC Davis to the University of Ghent, in Belgium, meanwhile, are creating crop plants resistant to drought, salt, and disease. And the Rockefeller Foundation, in New York City, is investing millions of dollars in a lofty project of its own: rice engineered to resist disease and provide plentiful nutrients for the exploding populations of the developing world.

Alvin Young, director of the Office of Agricultural Biotechnology at the U.S. Department of Agriculture (USDA), believes the technology for the transformed crops comes in the nick of time. "World population will probably double in the next forty years," declares Young, "forcing us to produce twice as much food on the same amount of land." The solution? "A global gene pipeline," according to Young, that delivers the seeds of plants engineered to thrive in precise locales. He goes on, "We will have cassava plants tailored for India and cassava plants tailored for Kenya. We will engineer plants that can thrive under tremendous regional pressures, from drought to chemical pollution to the onslaught of cold. By the year 2010 the technology will be pervasive, because it is based on the ability to manipulate biologically based systems at the ultimate level—the gene."

But many are disturbed by the awesome power of the technology. Michael Picker, head of Sacramento's National Toxics Campaign, says that when molecular biologists alter genes, they may be changing organisms in ways that will not be truly known for years. "Just one handful of soil contains billions of interacting bacteria," Picker explains. "When we dramatically shift the genetic makeup—and the functioning—of a single organism, how do we know it won't affect the whole chain?"

Critics also fear the new technology will tie us ever more tightly to what they call silver-bullet solutions—one-shot cures based on chemicals and genetically engineered organisms that must be produced and supplied by industry on a continual basis to keep a farm going. According to Jane Rissler, a plant pathologist and biotechnology specialist at the National Wildlife Federation, such solutions place control over agriculture—and food production as a whole—in the hands of companies interested only in expanding market position, not in helping humankind. "The more research money we pour into these silver-bullet solutions," she says, "the less likely we'll be to find other, more sustainable means of controlling crop disease and weeds."

Rissler believes it's no accident that many of the researchers in this field—she calls them gene-jockeys—are men. "They get a thrill out of creating life," she says. "I know a man out in California who talks about building potatoes. He's going to build potatoes by adding genes. What arrogance! Man, you've already got a potato. You're just tinkering!"

Of course, both men and women have tinkered with crops since the beginning of agriculture. When our ancestors left the forest for the open plains some 40,000 years ago, they survived as hunter-gatherers, picking fruits and berries and trekking after game. When they finally domesticated plants and animals in their own backyard, they learned to nurture those that were hardier or more fertile so they could produce a little more.

The scope of the new herbicide-resistant plants has grown vast. Companies are engineering herbicide resistance into virtually all major food crops.

In the 1940s, the powerful arm of science revolutionized agriculture to feed the ever-expanding population of the world. While war raged across the globe, American agronomist Norman Borlaug, father of the first green revolution, worked in the fields of Mexico. Crossbreeding wheat, he developed high-yield crops far more resistant than standard varieties to disease and weather damage. Borlaug's extraordinary work helped to increase food supplies in Mexico and throughout Asia.

But while Borlaug and colleagues managed to increase food production, in many cases the environment paid a heavy price. The bold new crops were able to grow only with the help of chemical fertilizers and pesticides, along with controlled irrigation and drainage. In 1962 biologist Rachel Carson exposed the devastating impact of such chemicals in her classic, *Silent Spring.* Carson pointed out that farm chemicals such as the pesticide DDT were draining into streams and rivers, killing fish, plants, and the animals that fed on them. Soon the science of engineering the new agricultural order—the one based on all those chemicals—was at war with the science of protecting the environment.

In 1973 an enormous scientific advance seemed to herald a truce between the two camps. A couple of California scientists, geneticist Stanley N. Cohen of the Stanford University School of Medicine and biochemist Herbert W.

MAKE A DIFFERENCE MAKE A DIFFERENCE

Boyer of the University of California, San Francisco, developed technology for transferring foreign genes into bacteria. In a splashy display of the technique, the team used molecular "scissors" known as restriction enzymes to snip genes out of the chromosome of a toad cell. Then they inserted a toad gene into a plasmid, a small packet of DNA able to sneak genetic information into foreign bacteria. Soon a whole population of bacteria had begun to incorporate and reproduce toad genes, becoming some of the first critters ever based on the breakthrough technology called recombinant DNA.

If plants could be transformed like this, researchers started saying, then it would not be long before we could engineer crops with genes for almost any characteristic at all. Who would need pesticides when plants could incorporate genes conferring resistance? And who would need chemical fertilizer when crops with internal nitrogen fixation genes could create their own? At last they had a beneficent science that might blast chemicals from the agricultural scene.

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But Monsanto, one of the first multinational companies to invest heavily in agricultural biotech, had another idea. Aware that the technology could be used to endow plants with new genes—and new traits—the company saw a means of bolstering its own revenues, which at the time were threatened by attacks on farm chemicals.

Under the direction of an energetic biologist, the late Howard Schneiderman, Monsanto built the $165 million Life Sciences Research Center on 210 acres west of St. Louis. By 1983 two of the hundreds of researchers hired by Schneiderman—Robert T. Fraley and Robert Horsch—had created the world's first "transformed plant," a petunia that incorporated the genes from a bacterium. The race to create engineered products for tomorrow's farm had begun.

Rebecca Goldburg, now chair of the biotechnology program at the Environmental Defense Fund (EDF), in New York City, began to scrutinize such products in 1986. Jeremy Rifkin, president of the Washington-based Foundation on Economic Trends, voiced strong opposition to the release of genetically engineered microbes. The most publicized of these, the notorious Ice-Minus, was a strain of bacterium genetically altered so it would no longer produce the protein that causes dew to freeze when temperatures hit between 25 and 30 degrees Fahrenheit. The idea was to coat strawberries, potatoes, and other crops with Ice-Minus, crowding out naturally occurring bacteria and giving the plants an extra measure of frost protection.

Steven E. Lindow, a plant pathologist from the University of California, Berkeley, who directed the project, insisted the release of Ice-Minus was inherently safe. In a background report issued at the time, the university itself said that "neither the commonly occurring bacteria, nor the modified ones, are harmful to humans or animals. The modified bacteria are nearly identical to the strains found on crops and other plants everywhere. The only difference is that they lack the single gene that allows ice to form on plant leaves. Such variations," the university added, "occur in nature, so the strain being tested is 'new' only in [terms of] the technique used to make the change. No new traits have been added."

Rifkin disagreed, pointing out that virtually no research had been done on the long-term effects of genetic engineering. "People will pay for this hundreds of thousands of years from now," Rifkin said at the time. "Every introduction is a hit-or-miss ecological roulette."

As for Goldburg, she was more concerned about future uses of the technology than about Ice-Minus itself. And she felt that both camps were naive. "The genetic engineers claimed that nothing they did could in any way be risky," she recalls, "in part because everything that could have happened to

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microorganisms had already been tried by evolution itself. But even if a mutation has occurred before, that's not the same as putting millions of altered microbes in a new environment in which those organisms will thrive."

Unlike Rifkin, however, Goldburg was not concerned about creating monsters but about creating pests. "I didn't think we'd see the construction of an Andromeda strain," she says, "but just some new organism that would be costly, something that might make it hard to maintain natural areas in a pristine state."

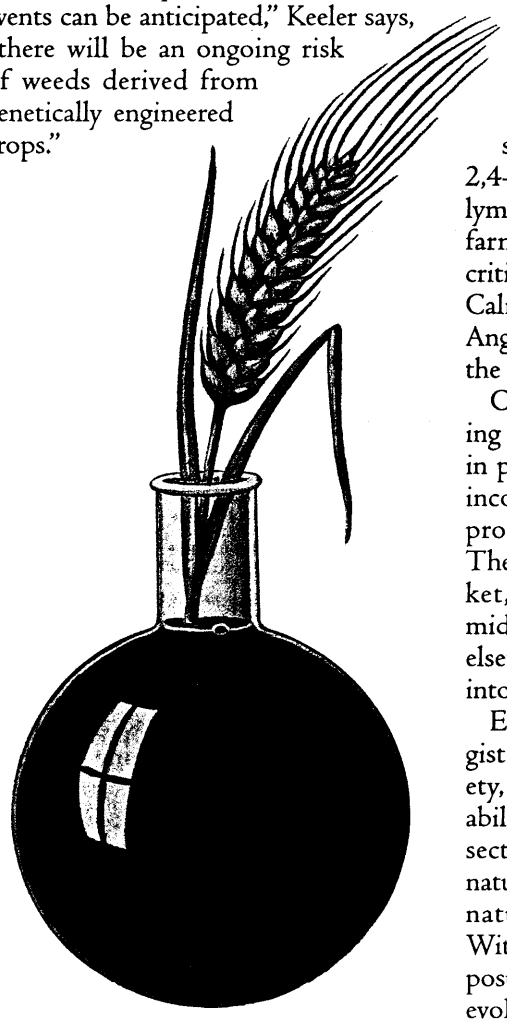
As the 1980s rolled around, one new technology bothered Goldburg the most. In field tests around the nation and the world, chemical companies were starting to pioneer cotton and soybeans, tomatoes and tobacco, engineered to resist the companies' own herbicides—a new generation of weed killers the corporations claimed were far less toxic than herbicides used before.

As Goldburg saw it, since the resistant new crops could grow in the presence of amounts of herbicide that would harm or kill nontolerant crops, there would be little incentive for farmers to control their herbicide use. The growers of the world would become tied ever more tightly to the cycle of chemicals, missing out on the promise of sustainable agriculture made so many years before.

Goldburg and colleagues also worried that the resistant new crops would pollinate closely related weedy species, thus passing on herbicide resistance to their weedy relatives. Whether or not this will actually occur is still a matter of debate. Chemical companies cite studies showing that if crops are controlled and kept far from weedy relatives, genetic drift will be insignificant. "We've conducted a large-scale study to see if genes for herbicide resistance flowed out of our cotton plants into other fields," says Calgene's Salquist, "and found that if there's a certain amount of space between fields, they do not."

Yet a review of professional journals shows that many scientists are not convinced. Ecologist and evolutionary biologist Kathleen H. Keeler of the University of Nebraska points out that a weedy race of millet seems to have evolved just recently in Wisconsin and Minnesota—after 200 to 300 years of millet cultivation in North America without weed problems. "Until such events can be anticipated," Keeler says, "there will be an ongoing risk of weeds derived from genetically engineered crops."

Advocates say biotech will increase wheat yields, sweeten tomatoes, and ward off disease. Critics foresee a renewed reliance on chemicals.



With so much still unknown, the scope of the new herbicide-resistant crops has nonetheless grown vast. Working with France's Rhône-Poulenc Agricultural Company, Calgene has developed cotton resistant to the herbicide Bromoxynil. Germany's Hoechst is engineering maize resistant to its herbicide Basta. And the USDA itself is developing plants resistant to 2,4-D, a close relative of the defoliant Agent Orange and a common ingredient in many agricultural applications. These groups and others are engineering herbicide resistance into virtually all major food crops, from rice and corn to potatoes and wheat.

Some of these herbicides may pose dangers to farm workers and the population at large. According to the Environmental Protection Agency (EPA), for instance, a recent study shows that pregnant rats exposed to Bromoxynil either orally or through skin contact bear offspring with defects. The agency is so concerned about this herbicide that it now requires all workers who load, mix, or apply the chemical to wear protective garb. A 1990 study by the National Cancer Institute shows that the common weed killer 2,4-D tripled the risk of cancer of the lymph nodes in a group of Nebraska farmers. The use of Atrazine, already criticized for polluting groundwater in California's Central Valley and in Los Angeles, has been restricted in parts of the state.

Chemical companies are also extending their markets in pesticides. A case in point: Monsanto's B.t. cotton, which incorporates bacterial gene coding for protein crystals lethal to bollworms. The product should be ready for market, says Monsanto's Fraley, by the mid-'90s. Scientists at Monsanto and elsewhere are also engineering B.t. genes into potatoes, corn, and other crops.

Ed Bruggemann, a molecular biologist with the National Audubon Society, says, "Engineered plants have the ability to reduce the use of chemical insecticides. Indeed, when B.t. found in nature is simply sprayed on plants as a natural pesticide, resistance results. With B.t. engineered into the plant, exposure will be greater and the force to evolve resistance more intense. Insects can develop resistance to B.t. just as they develop resistance to chemical insecticides. The concern is that this technique will work for just a few years, then farmers will have to return to chemical pesticides." Bruggemann recommends that companies look for ways to prevent the new strains from quickly becoming obsolete.

"Trouble is," he says, "companies have little incentive to extend the life of

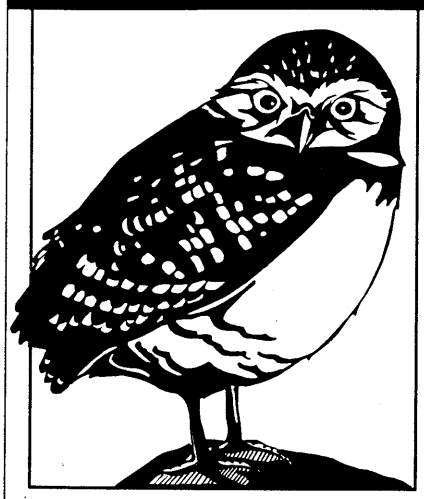
the product because they can hold the patent for only seventeen years. It may be to the corporation's great advantage to have old products die so new ones can come to the fore. Corporations would rather sell more of the product at the start, and get their money back as soon as they can. B.t. crops will last three to four years if we use the product poorly, and thirty to forty years if we use the product well."

Fraley says Monsanto shares Bruggemann's concerns and has a resistance-management program firmly in place. "We're investigating a whole spectrum of strategies," he states, "to prolong the usefulness of our B.t. crops." For instance, the company is combining B.t. pesticides with limited application of traditional chemical pesticides. It's also trying a technique known as integrated pest management, in which planting and harvesting are timed to exploit natural predators to help eliminate pests. Finally, company scientists plan to develop different B.t. varieties so that if pests become immune to one, another will be ready to take its place.

The final product in the process—genetically engineered food—comes with some promise. There is Calgene's engineered canola plant. Monsanto is gearing up to produce potatoes with greater starch content, which absorb less oil and fat, to produce healthier chips and fries. And Louisiana State University scientists are developing nutritious forms of rice with storage proteins from beans and peas.

But Goldburg feels it's impossible to know the impact of gene changes in food without intensive analysis. Engineered foods could be a concern for people with allergies and could play havoc with religious dietary laws. After all, even a passing glance at the field test applications on file at the USDA reveals potatoes with chicken and insect genes, walnuts with bacterium genes, and rice with genes from corn.

Roger Salquist says that Calgene, for one, has analyzed the Flavr Savr for toxins and changes in nutrient content and found none. But Goldburg warns that other companies may follow through only if adequate regulations are in place. In a recent report entitled *A Mutable Feast: Assuring Food Safety in the Era of Genetic Engineering,* Goldburg and other



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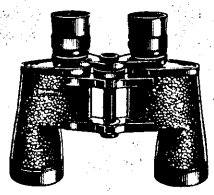

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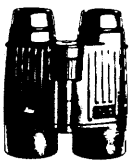

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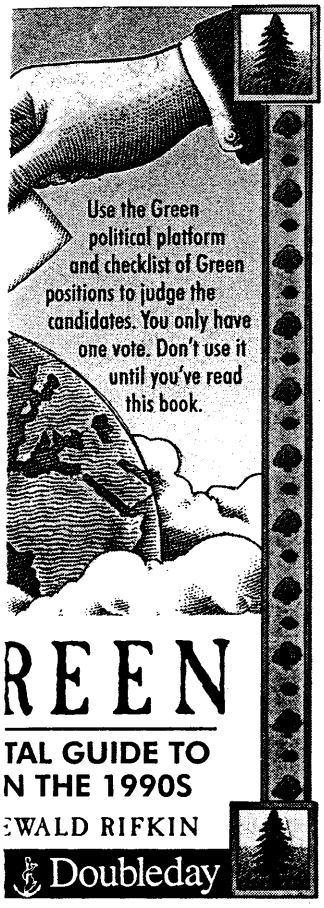

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EDF staffers call for a new roster of rules: If genetically engineered food contains a new substance, the Food and Drug Administration (FDA) should regulate and label it like any other product with an additive. And all such foods should be analyzed for elevated levels of naturally occurring toxins or decreasing levels of nutrients, just to make sure they're appropriate and safe.

As multinational corporations like Monsanto and Ciba-Geigy begin to integrate development of the seeds, the agrichemicals, and possibly the food itself, they may achieve a new level of control over the agricultural resources of the world. Already, says Jack Doyle, Director of the Agricultural and Biotechnology Project at Friends of the Earth, these huge corporations have begun to buy up smaller genetic engineering and seed companies. The result, he believes, will be a "life sciences conglomerate," an unprecedented institution of enormous economic and political power.

These megacompanies, says Doyle, "are using genes just as earlier corporate powers used land, minerals, or oil. In many ways, DNA is the ideal corporate resource: It can be patented and wielded as property. It can be manipulated in the laboratory. It can replace or reduce reliance on cumbersome raw materials like farmland or feedstocks, reduce labor costs, and circumvent finicky variables such as weather. Finally, DNA can be used to produce tremendous quantities of rare and expensive products for pennies." As Doyle points out, the mergers and buyouts in the biotechnology arena do not represent a new form of efficiency or economic vibrancy with the potential to help humankind. Rather, the technology is being wielded so that companies may extend current market positions and establish others.

This trend is exacerbated, says UC Davis rural scientist Martin Kenney, because even university scientists are receiving more funding from industry. According to Kenney, author of *Biotechnology: The University-Industrial Complex*, "Large companies like Monsanto fund university research programs at up to four hundred thousand dollars per shot. All you have to do is read the newspapers to see that in other cases professors are getting massive blocks of stock from companies they consult for." In effect, Kenney adds, industry has directed its funds so that university scientists do the basic molecular biology while the company itself develops the seed. "Thus, the university is not just providing seed free to small seed firms and farmers, as was done in the past. Instead, large companies create the seed and link it, at the genetic level, with a chemical. The companies set the agenda and become the central conduit in the production of our food."

With clear and balanced regulations, these problems and others might be kept under control. But the regulations governing biotechnology, say many experts, are tangled and obscure. To gain approval for a field test, researchers must apply to the USDA. If their product is considered a pesticide (B.t. cotton, for instance) or a toxin released into the environment (Ice-Minus), they must apply to the EPA as well. Once the product is ready to be marketed as a food (Calgene's tomato), it also falls under the domain of the FDA.

David MacKenzie, director of the USDA's National Biological Impact Assessment Program, says that many independent researchers are discouraged from conducting field tests because wading through the regulations is such a chore. "Companies like Monsanto," says MacKenzie, "have employees who work full-time just negotiating the regulatory maze. As a result, many profit-making applications move forward while more beneficial projects never see the light of day."

While the regulatory maze is nothing new, biotechnology is. And, say the critics, this striking new technology should be governed by laws of its own. But a new Bush administration policy, written by the staff of Vice-President Quayle and his Council on Competitiveness, holds that genetically engineered products are not intrinsically dangerous and that they deserve no more scrutiny than products created in a more conventional way. Regulatory review of biotech, the administration now says, should be "designed to bring

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products to market without too many roadblocks put in the way."

"This four-billion-dollar industry should grow to fifty billion by the end of the decade—if we let it," President Bush recently told the U.S. Chamber of Commerce. "The United States leads the world in biotechnology, and I intend to keep it that way."

To that end, the FDA announced in May that it will approve genetically engineered foods without considering them inherently dangerous or requiring extraordinary levels of testing—unless special safety issues, including the problem of food allergies, arise. According to the White House, the FDA policy will serve as a model for officials at the USDA and the EPA, two other agencies involved in regulating biotech.

The Bush administration's approach disturbs Goldburg, who finds that it leaves a policy "so vague that the Office of Management and Budget will be able to block any regulation it wants. I foresee a regulatory vacuum as a result."

But Terry Medley, director of Biotechnology, Biologics, and Environmental Protection at the USDA, says the current regulations are completely sufficient to regulate biotech products: "Our role is to make the most rational, the most informed, decision by scientifically assessing the risks using all the information we have at hand. And that is something, given our expertise, we can do."

In fact, Medley and other USDA officials seem to be on a biotech mission. "You've heard of Star Trekkers," Medley says. "Biotekkers are people involved in biotechnology." It's no surprise that Medley brings with him not just the regulator's narrow focus, but also the visionary's zeal. "We believe this technology will pave the way to sustainable agriculture," he says, "reducing our reliance on chemicals and providing farmers with choices that can cut their costs. Over the long term, we'll create value-added crops—crops with higher nutritional value, crops that grow despite cold or drought. This is a global issue. The regulations we set here will help to establish standards worldwide." Medley says those international standards will come in especially handy for nations with the least sophistication, those of the Third World.

Gary Toenniessen, the Rockefeller Foundation's associate director of agricultural sciences, says that "in the next century, Third World countries will need to grow increasingly more food on the same amount of land. Yet the existing technology has already pushed rice production as high as it can. American and European corporations had little interest in this effort, which didn't have much profit potential in the developed world." Rockefeller-supported researchers at institutions as diverse as the University of Nottingham, in the United Kingdom, and Scripps Research Institute, in San Diego, are engineering rice that resists viral disease, withstands drought, and produces a higher yield. According to Toenniessen, a major thrust of the effort involves training Third World scientists from nations like Thailand, Nepal, and Bangladesh to modify and implement the technology themselves.

"You've heard of Star Trekkers," says one USDA official. "Biotekkers believe technology will pave the way to sustainable agriculture."

Robert Herdt, director of the foundation's agriculture program, meanwhile, is overseeing the environmental and social impacts of the technology. "We know the technology can be used in the wrong way, and it can make environmental problems worse," Herdt says. "On the other hand, we can direct our program so that these new crops do away with irrigation systems or pesticides that disrupt the environment. We won't support herbicide-resistant crops, because pulling weeds is a major source of income in the Third World. If herbicides killed the weeds, there would be far fewer jobs and we would be shifting money into the chemical companies and away from the poor."

Whether the focus is the developed or the developing world, of course, there's no guarantee that the safeguards Herdt envisions will be enforced. Bob Cantisano, a consultant on organic and sustainable farming, echoes the views of many when he says that if unchecked, "biotechnology will displace the farm community. By selling the seeds and the chemicals those particular seeds require, major corporations will concentrate agricultural wealth. Industry has no incentive to promote an agriculture with less chemical input, yet the input is now becoming so expensive that farmers can't survive. Biotechnology will mean more input and will further stress the small family farm."

Pointing to a vineyard unattended, a wheat field gone fallow, Charlie Rominger agrees that more farmers go under each and every year. "Those who farm like their grandfathers farmed," he says, "are winnowed out each cycle." Striving to stay economically and environmentally sound, the Romingers are growing organic tomatoes and are using USDA-imported wasps from Tashkent to control the aphids nibbling their wheat. Yet, Charlie Rominger concedes, biotechnology will probably become part of the arsenal he wields in sustaining his inheritance, the family farm. "We'll look at this technology carefully," he says. "We'll examine what others do first. But it looks like biotechnology will help us stay competitive, and we've got to stay competitive if we want to survive."

Your Move

For more information about genetic engineering and biotechnology, consult the following publications:

Biotechnology's Bitter Harvest: Herbicide-Tolerant Crops and the Threat to Sustainable Agriculture, *a report of the Biotechnology Working Group. Available from the Environmental Quality Department, National Wildlife Federation, 1400 16th Street NW, Washington, DC 20036-2266.*

Altered Harvest: Agriculture, Genetics and the Fate of the World's Food Supply, *by Jack Doyle (Viking, 1985).*

The Gene Exchange: A Public Voice on Genetic Engineering, *published four times a year by the National Biotechnology Policy Center of the National Wildlife Federation. Available on request from the center; write 1400 16th Street NW, Washington, DC 20036-2266.*

A series of bulletins, Workshops on Biotechnology, *is available from the National Audubon Society, 666 Pennsylvania Avenue SE, Washington, DC 20003.*