

By Karen Hopkin

# The Risks on the Table

More than half the foods in U.S. supermarkets contain genetically modified ingredients. Have they been proved safe for human consumption?



## A farmworker crouches in the hot Texas sun, harvesting celery for market. That evening, painful

red blisters erupt across his forearms. The celery—a newly developed variety prized for its resistance to disease—unexpectedly produces a chemical able to trigger severe skin reactions.

Traditional breeding methods generated this noxious vegetable. But opponents of genetically modified foods worry that splicing foreign genes (often from bacteria) into food plants through recombinant-DNA technology could lead to even nastier health surprises. The stakes are high: GM foods are sold in many countries. In the U.S., an estimated 60 percent of processed foods in supermarkets—from breakfast cereals to soft drinks—contain a GM ingredient, especially soy, corn or canola; some fresh vegetables are genetically altered as well.

Detractors cite several reasons for concern. Perhaps proteins made from the foreign genes will be directly toxic to humans. Maybe the genes will alter the functioning of a plant in ways that make its food component less nutritious or more prone to carrying elevated levels of the natural poisons that many plants contain in small amounts. Or perhaps the modified plant will synthesize proteins able to elicit allergic reactions.

Allergy was the big worry last year when StarLink corn—

genetically modified to produce an insecticidal protein from the bacterium *Bacillus thuringiensis* (Bt)—turned up in taco shells, corn chips and other foods. Before the corn was ever planted commercially, U.S. regulators saw signs that its particular version of the Bt protein could be allergenic; they therefore approved StarLink for use only in animal feed, not in grocery products. They are examining claims of allergic reactions to foods harboring that corn, but a scientific advisory committee has determined that the amounts in consumer products were quite low and thus unlikely to provoke allergic reactions.

Proponents offer a number of defenses for genetically engineered foods. Inserting carefully selected genes into a plant is safer than introducing thousands of genes at once, as commonly occurs when plants are crossbred in the standard way. GM crops designed to limit the need for toxic pesticides can potentially benefit health indirectly, by reducing human exposure to those chemicals. More directly, foods under study are being designed to be more nutritious than their standard counterparts. Further, GM crops that produced extra nutrients or that grew well in poor conditions could provide critical help

to people in developing nations who suffer from malnutrition.

Advocates note, too, that every genetically engineered food crop has been thoroughly tested for possible health effects. Relatively few independent studies have been published, but manufacturers have conducted extensive analyses, because they are legally required to ensure that the foods they sell meet federal safety standards. In the past, the companies have submitted test results to the U.S. Food and Drug Administration voluntarily in advance of sale. But an FDA rule proposed in January should make such review mandatory.

The manufacturers' studies typically begin by comparing the GM version under consideration with conventionally bred plants of the same variety, to see whether the addition of a foreign gene significantly alters the GM plant's chemical makeup and nutritional value. If the proteins made from the inserted genes are the only discernible differences, those proteins are checked for toxicity by feeding them to animals in quantities thousands of times higher than humans would ever consume. If the genetic modification leads to more extensive changes, toxicity testers may feed the complete GM food to lab animals.

To assess the allergy-inducing potential, scientists check the

to be abandoned before they had a chance to hit grocery shelves. "I don't know of any evidence that any product on the market is unsafe," says Peter Day, director of the Institute of Biomolecular Research at Rutgers University.

The safety tests are not necessarily foolproof, though. For example, GM plants often cannot make enough of the foreign protein for use in feeding studies. So researchers have bacteria churn out the proteins. But a protein made by plants, the form people would consume, might be slightly different from the one made by microbes—a difference that might theoretically affect the safety assessment of that protein. And studies using whole GM foods are limited by the amount of any food that can be introduced into an animal's diet without generating nutritional imbalances that can confound the test results. This effect is one reason that scientists have criticized a controversial 1999 study claiming that the foreign DNA in GM potatoes led to abnormalities in the intestinal lining in rats.

Beyond the acute safety considerations, some critics fear that GM foods will do harm more insidiously, by hastening the spread of antibiotic resistance in disease-causing bacteria. When food designers genetically alter a plant, they couple the

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chemical makeup of each novel protein produced by the genetically altered plant against those of 500 or so known allergens; having a similar chemistry would raise a red flag. Proteins are also treated with acid to mimic the environment they will encounter in the stomach; most known allergens are quite stable and survive such treatment unscathed. Finally, investigators consider the original source of the protein. "There is no way that a peanut gene will ever be allowed into a strawberry," observes T. J. Higgins of the Commonwealth Scientific and Industrial Research Organization in Australia: too many people are allergic to proteins in peanuts.

Arguably, the testing system has worked well so far. It showed that the protein in StarLink corn might be allergenic (hence the animal-feed-only approval) and led other products—such as soybeans that contained a protein from Brazil nuts—

selected genetic material with a "marker" gene that reveals which plants have taken up foreign genes. Often the marker genes render plant cells resistant to antibiotics that typically kill them. At issue is the possibility that resistance genes might somehow jump from GM foods to bacteria in a consumer's gut, thereby aggravating the already troubling rise of antibiotic resistance among disease-causing bacteria.

The chances of such transfer are reportedly remote—"less likely than winning a national lottery three times in a row," notes Hans Günter Gassen of the Institute of Biochemistry at the University of Technology in Darmstadt, Germany. Even so, to allay public concern, the use of antibiotic resistance genes will probably be phased out in the next five years.

Meanwhile many consumers remain disturbed that most safety tests are performed by the very corporations that produce GM foods. Steve L. Taylor, head of the department of food science and technology at the University of Nebraska, admits that some may view the practice as unseemly. But, he asks, who else should shoulder the burden—and the expense? "I'd rather see the companies spend the money than have the government use my tax dollars," he adds. "I don't care if we're talking about bicycles or GM corn, it's their obligation to prove that their products are safe." No doubt concerned scientists and citizens will continue watching to see that they do so. 

### MORE TO EXPLORE

**Adequacy of Methods for Testing the Safety of Genetically Modified Foods.** H. A. Kuiper et al. in *Lancet*, Vol. 354, No. 9187, pages 1315–1316; Oct. 16, 1999.

**Effect of Diets Containing Genetically Modified Potatoes Expressing Galanthus Nivalis Lectin on Rat Small Intestine.** S.W.B. Ewan and A. Pusztai in *Lancet*, Vol. 354, No. 9187, pages 1353–1354; Oct. 16, 1999.

**Safety Aspects of Genetically Modified Foods of Plant Origin.** Report of a joint FAO/WHO expert consultation on foods derived from biotechnology. Geneva, June 2000. Available at [www.who.int/fsf/gmfood/fao-who\\_consultation\\_report\\_2000.pdf](http://www.who.int/fsf/gmfood/fao-who_consultation_report_2000.pdf)

**Possible Health Risks of GM Foods.** H. G. Gassen. Available from the OECD Web site at [www.oecd.org/subject/biotech/Gassen.pdf](http://www.oecd.org/subject/biotech/Gassen.pdf)

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