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...
Detractors cite several reasons for concern. Perhaps proteins made from the foreign genes will be directly toxic to humans. Perhaps GM plants will elicit allergic reactions.

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 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.

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

MORE TO EXPLORE


Karen Hopkin is a science writer based in Somerville, Mass.