



FREE NEJM E-TOC

HOME

SUBSCRIBE

CURRENT ISSUE

PAST ISSUES

COLLECTIONS

Keyword, citation, or author

SEARCH

Advanced Search

COLBY COLL LIB | [Get NEJM's E-Mail Table of Contents - FREE](#) | [Sign In as Individual](#) | [Contact Administrator](#)

## EDITORIAL

[◀ Previous](#)

Volume 334:726-728

March 14, 1996

Number 11

[Next ▶](#)

# Allergies to Transgenic Foods — Questions of Policy

Food biotechnology, the use of recombinant-DNA and cell-fusion techniques to confer selected characteristics on plants and animals used for food,<sup>1</sup> can be used to increase agricultural productivity. The great promise of biotechnology is that the use of these techniques will help solve world food problems by creating a more abundant, more nutritious, and less expensive food supply. Despite this promise, public concern about the safety, usefulness, and social consequences of genetically engineered food products has led to boycotts, legislative bans, and demands for stronger federal regulation.<sup>2</sup> Such actions have caused leaders of the biotechnology industry to identify public "biotechnophobia" as the most serious threat to commercialization of their products and to view as their most critical challenge the need to reassure people that the new techniques are both safe and beneficial.<sup>3</sup>

Questions of safety vex federal regulators and industry as well as the public. The transfer of genes from microbes, plants, or animals into foods raises issues about the unintended consequences of such manipulations. Allergenicity could be one such consequence. Genes encode proteins; proteins can be allergenic. Biotechnology companies might be introducing allergenic proteins from donor organisms into the food supply. The Food and Drug Administration (FDA) anticipated this problem in 1992 when it devised its policy on transgenic plant foods.<sup>4</sup> But because this policy requires premarketing notification of the FDA, premarketing safety testing, and labeling only of foods with genes transferred from the 8 to 10 most commonly allergenic foods, public-interest groups have cautioned that existing rules inadequately protect people against lesser-known transgenic allergens to which they might be sensitive.<sup>5</sup>

In this issue of the *Journal*, Nordlee and her colleagues confirm that food allergens can indeed be transferred from one plant to another by transgenic manipulation — in this case, from Brazil nuts to soybeans.<sup>6</sup> They identify 2S albumin as the principal allergen of the Brazil nut and demonstrate that people who react to Brazil-nut extracts on standard skin-prick tests have similar reactions in response to extracts of transgenic soybeans that contain 2S albumin. The authors also collected serum from people known to be allergic to Brazil nuts and analyzed the ability of proteins in transgenic soybeans to bind to IgE in the serum samples, using radioallergosorbent tests and sodium dodecyl sulfate–polyacrylamide–gel electrophoresis.

Unique circumstances permitted this demonstration of transgenic allergenicity. Pioneer Hi-Bred International developed the transgenic soybeans used in this study in an attempt to increase the amount of sulfur-containing amino acids — methionine and cysteine — in soy-based animal feeds. Such feeds must otherwise be supplemented with methionine (which can be converted to cysteine) to promote optimal growth. The Brazil-nut 2S albumin is exceptionally rich in methionine and cysteine; its gene was a logical choice as a donor. Nuts are known to cause IgE-mediated hypersensitivity reactions that range from mild itching to sudden death.

This study highlights gaps in our current knowledge of food allergies. Stored serum samples from people with specific food sensitivities are limited; in the absence of such samples, the demonstration of the allergenicity of a food is less compelling. Thus, although about one fourth of Americans believe that they or

### TOOLS & SERVICES

- ▶ [Add to Personal Archive](#)
- ▶ [Add to Citation Manager](#)
- ▶ [Notify a Friend](#)
- ▶ [E-mail When Cited](#)

### MORE INFORMATION

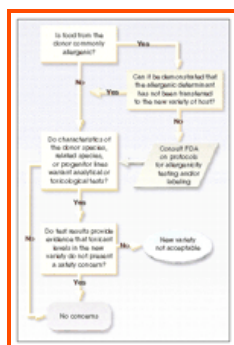
- ▶ [PubMed Citation](#)

their children are allergic to specific foods, adverse reactions to the food are confirmed by testing of serum samples or the more precise double-blind challenge tests in no more than 2 percent of adults and 8 percent of children.<sup>7</sup> Many more people may have food sensitivities, however, especially since the prevalence of such conditions seems to be increasing as more proteins are added to commercially prepared foods.<sup>8</sup> Furthermore, most biotechnology companies use microorganisms rather than food plants as gene donors, even though the allergenic potential of these newly introduced microbial proteins is uncertain, unpredictable, and untestable.<sup>4</sup>

Pioneer Hi-Bred developed its soybeans for use in animal feeds, but there is no easy method of separating soybeans destined for animals from those slated for human consumption. Soy proteins, which are less allergenic than milk proteins, are used in infant formulas, meat extenders, baked goods, and dairy substitutes. Because the consumption of soy-based foods appears to reduce the risks of heart disease and cancer,<sup>9</sup> the prevalence of soy proteins in foods consumed by infants and adults is sure to increase.

From the standpoint of human nutrition, soybeans are just fine the way they are. Their methionine content is sufficient and not a problem; even if used as the sole source of dietary protein, soy foods maintain nitrogen balance and support growth in adults, children, and full-term infants and must be supplemented only in feeding premature infants.<sup>10</sup>

The results of the study by Nordlee et al.<sup>6</sup> have important regulatory implications. The 1992 FDA policy on transgenic plant foods begins with the premise that the techniques used to create these products raise no new or unusual safety issues.<sup>4</sup> As is the case for other foods generally recognized as safe, the FDA has the authority to remove transgenic foods from the marketplace if unexpected problems arise. When transgenic foods contain genes transferred from donors that are commonly allergenic, the FDA considers them to be governed by food-additive regulations and requires premarketing notification, testing, and labeling.<sup>4</sup> [Figure 1](#) shows the FDA protocol for gene transfers involving donors that are commonly allergenic. Under this policy, Pioneer Hi-Bred was required to — and did — consult the FDA about the need for premarketing safety testing. Given the results of the present study, the company would have had to label its transgenic soybeans. Instead, it discontinued plans to market them.



**Figure 1.** The FDA Protocol for the Development of Potentially Allergenic Transgenic Foods by Biotechnology Companies.

If a gene from a commonly allergenic food is likely to be transferred to a host plant, this protocol requires companies to consult the FDA, test for allergenicity, and label the product. Reprinted verbatim from the Food and Drug Administration.<sup>4</sup>

[View larger version](#)  
(38K):

[\[in this window\]](#)

[\[in a new window\]](#)

Because FDA requirements do not apply to foods that are rarely allergenic or to donor organisms of unknown allergenicity, the policy would appear to favor industry over consumer protection. In a discussion of 3300 public comments on the policy, one report noted that biotechnology companies generally supported the policy but that consumer groups thought it delegated too much of the responsibility for premarketing safety testing to industry.<sup>5</sup> As a result, the report recommended a review of federal oversight of food biotechnology in order to develop a more equitable regulatory balance between promoting industry and protecting the public.

In 1993 the FDA requested public comment on whether and how to label food allergens in transgenic foods,<sup>11</sup> but the agency has not yet reported or taken action on the responses. Although the labeling of

transgenic foods raises complex regulatory issues, surveys indicate strong public support for doing so.<sup>12</sup> One reason for labeling is that avoidance is still the best — and sometimes only — defense against food allergies.<sup>7</sup> In 1994 the FDA and several other federal agencies held a conference on scientific issues related to the allergenicity of transgenic foods. The participants discussed the gaps in information on food allergies and the need to find ways to identify less common allergens, but they reached no firm conclusions about how to deal with these issues. The FDA has released a transcript of the conference<sup>13</sup> but has not issued a formal report or recommendations.

The FDA has recently drafted a premarketing-notification rule that would require companies to inform the agency when they are developing transgenic foods, in part to help resolve the safety issues related to allergenicity.<sup>14</sup> In the current climate of deregulation, the implementation of any new premarketing-notification rule seems unlikely, particularly since the biotechnology industry is demanding that such a requirement be limited in scope and end after three years.<sup>15</sup> The unresolved status of this regulatory policy means that the responsibility for protecting the public against uncommon or unknown allergens in transgenic foods will continue to be delegated to industry and largely voluntary.

This situation illustrates the pressing need to expand basic and clinical research on food allergies. More information about incidence, prevalence, dietary exposure, antigenicity, immune responses, diagnosis, and treatment would help researchers, regulators, and biotechnology companies predict whether transgenic proteins are likely to cause harm. In the special case of transgenic soybeans, the donor species was known to be allergenic, serum samples from persons allergic to the donor species were available for testing, and the product was withdrawn. The next case could be less ideal, and the public less fortunate. It is in everyone's best interest to develop regulatory policies for transgenic foods that include premarketing notification and labeling. Industry benefits when the public is convinced that transgenic foods are safe, and stronger federal regulations would encourage such public confidence.

Marion Nestle, Ph.D., M.P.H.  
New York University  
New York, NY 10012-1172

## References

1. Carroll WL. Introduction to recombinant-DNA technology. *Am J Clin Nutr* 1993;58:Suppl:249S-258S. [[Free Full Text](#)]
2. Hopkins DD, Goldburg RJ, Hirsch SA. *A mutable feast: assuring food safety in the era of genetic engineering*. New York: Environmental Defense Fund, 1991.
3. Gaull GE, Goldberg RA, eds. *New technologies and the future of food and nutrition*. New York: John Wiley, 1991.
4. Food and Drug Administration. Statement of policy: foods derived from new plant varieties. *Fed Regist* 1992;57:22984-23004.
5. General Accounting Office. Food quality and safety: innovative strategies may be needed to regulate new food technologies. Washington, D.C.: General Accounting Office, July 1993. (GAO/RCED-93-142.)
6. Nordlee JA, Taylor SL, Townsend JA, Thomas LA, Bush RK. Identification of a Brazil-nut allergen in transgenic soybeans. *N Engl J Med* 1996;334:688-692. [[Free Full Text](#)]
7. Sampson HA, Metcalfe DD. Food allergies. *JAMA* 1992;268:2840-2844. [[CrossRef](#)][[Medline](#)]
8. Sampson HA, Mendelson L, Rosen JP. Fatal and near-fatal anaphylactic reactions to food in children and adolescents. *N Engl J Med* 1992;327:380-384. [[Abstract](#)]
9. First International Symposium on the Role of Soy in Preventing and Treating Chronic Disease, Mesa, Ariz., February 20-23, 1994: symposium proceedings. *J Nutr* 1995;125:Suppl:567S-808S.
10. Erdman JW Jr, Fordyce EJ. Soy products and the human diet. *Am J Clin Nutr* 1989;49:725-737. [[Free Full Text](#)]
11. Food and Drug Administration. Food labeling: foods derived from new plant varieties. *Fed Regist* 1993;58:25837-25841.
12. Hoban TJ, Kendall PA. *Consumer attitudes about food biotechnology: project summary*. Raleigh: North Carolina State University, 1993.
13. Food and Drug Administration, Environmental Protection Agency, Department of Agriculture. *Conference on scientific issues related to potential allergenicity in transgenic food crops*, Annapolis, Md., April 18-19, 1994. Baltimore: Free State Reporting, 1994. (Docket 3 94N-0053.)
14. Maryanski discusses next wave in biotech, premarket issues. *Food Chemical News*. January 23, 1995:34-5.

15. BIO favors limited notification on biotech food, 3-year sunset. Food Chemical News. May 16, 1994:7-8.

## This article has been cited by other articles:

- Howland, L. C., Gortmaker, S. L., Mofenson, L. M., Spino, C., Gardner, J. D., Gorski, H., Fowler, M. G., Oleske, J. (2000). Effects of Negative Life Events on Immune Suppression in Children and Youth Infected With Human Immunodeficiency Virus Type 1. *Pediatrics* 106: 540-546 [\[Abstract\]](#) [\[Full Text\]](#)

### TOOLS & SERVICES

- ▶ Add to Personal Archive
- ▶ Add to Citation Manager
- ▶ Notify a Friend
- ▶ E-mail When Cited

### MORE INFORMATION

- ▶ PubMed Citation

---

HOME | SUBSCRIBE | SEARCH | CURRENT ISSUE | PAST ISSUES | COLLECTIONS | PRIVACY | HELP |  
beta.nejm.org

Comments and questions? Please [contact us](#).

The New England Journal of Medicine is owned, published, and [copyrighted](#) © 2009 [Massachusetts Medical Society](#). All rights reserved.