

Biotech In focus

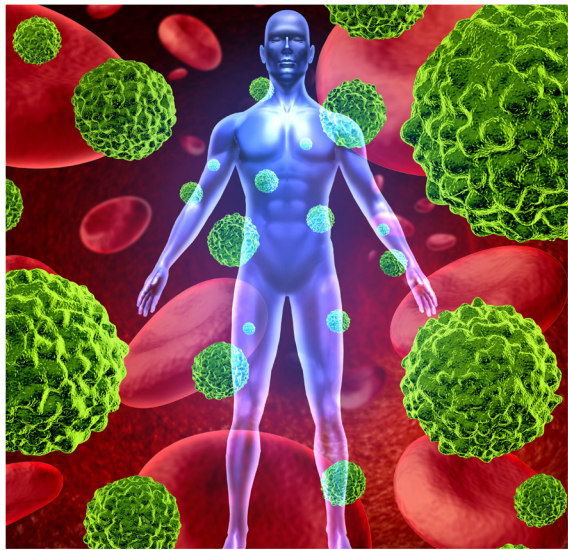


Cooperative Extension Service
Biotechnology Outreach Program
College of Tropical Agriculture and Human Resources
University of Hawai'i at Manoa

May 2014

Issue 10 of 24

GMOs and Human Health I: Does eating foods from GMO crops cause allergies?



To head off infection by infectious microbes, viruses or parasites, our bodies rely on our immune system—organs, tissues, cells, and proteins working together to identify possible invaders and attack them.

Many immune system activities involve **antibodies**, which are defensive proteins we make to bind and target foreign molecules, usually proteins or sugars, found on the bacteria, viruses and parasites. The molecules bound by antibodies are called **antigens**.

Unfortunately, our remarkable defenses sometimes become active even when no threat is present. One type of dysfunctional immune response is **allergy**. During a typical allergic reaction, a type of antibody called immunoglobulin E—IgE for short—binds to a normal substance from the environment and tells the immune system to attack it as a foreign invader. The substance (antigen) that provokes this IgE response is called an allergen.

Proteins in foods from animals or plants can be allergens. The Food and Drug Administration recognizes eight common foods that trigger the vast majority of food allergies: cow's milk, soy, eggs, wheat, peanuts, tree nuts, fish, and shellfish. Food allergies may result in hives, rashes, upset stomach or intestines, stuffy nose, sneezing, headache, asthma, and anaphylaxis, a rapid and sometimes deadly reaction associated with swelling and low blood pressure. Not all adverse reactions to foods are allergies. Some food sensitivities involve other types of immune responses, and there are many forms of food intolerance that relate to digestion rather than the immune system.

The prevalence of food allergies appears to be increasing. Centers for Disease Control surveys found that the percentage of parents who reported that their child had a food allergy within the past year increased from 3.4% in 1997–1999 to 5.6% in 2009–2011. Since this period coincides with the first years in which genetically engineered foods were widely eaten, some people believe that these two events are linked. What do we know about GMOs and allergens?



Ania Wieczorek, PhD

Associate Professor
Department of Tropical Plant
and Soil Sciences
College of Tropical Agriculture
and Human Resources
University of Hawai'i at Manoa
Honolulu, HI 96822
ania@hawaii.edu

Thank you to Carol Oshiro for
web design, Jessica Radovich for
graphics and Kathleen Vickers
for text editing.

Allergenic Traits

Since genetic engineering transfers genes (the DNA recipes for proteins) from one organism to another, a genetically engineered plant can trigger an allergic response if a host plant protein is allergenic anyhow, or if the new transgenic protein is allergenic. The question of whether host plant proteins are allergenic affects GMO and non-GMO crops equally: if you're allergic to soy, for example, you're allergic to both GM and non-GM varieties. (Research is underway to remove allergens from food crops by using genetic engineering, but such crops are not currently in commercial production.)

The potential allergenicity of each new transgenic protein is evaluated on a case-by-case basis during crop development. The reports that developers of new genetically engineered crops submit to the Food and Drug Administration include characteristics of the new protein that indicate whether it is likely to be allergenic.



Questions Answered

Questions answered in developer reports include:

- Is the new protein's species of origin known to cause allergies?
- How similar is the new protein's amino acid sequence to the sequences of known allergens?
- How readily does the new protein break down when treated with heat or digestive enzymes?

ANSWER

QUESTION?

Testing for Allergy



Other types of experiments that may be reported include allergenicity tests conducted in animals, laboratory tests that use human E—IgE antibodies to test the new protein for reactivity, and skin-prick tests on human volunteers with known allergies.

Allergens Halted

In the 1990s, these procedures were applied to a soybean that was being engineered to make more nutritious protein. A transgene from Brazil nut—a tree nut that causes allergies in some people—had been added to soybean to increase its levels of an amino acid, methionine. The new protein was identified as a likely allergen, and development of the soybean was immediately halted and it was never released.



To date, no confirmed allergic reactions have been linked to eating the new proteins present in transgenic crops. We don't know why food allergies are becoming more frequent, but there is no scientific evidence that genetically modified crops are contributing to this rise. Conventional plant breeding and mutational breeding can also introduce allergens during crop development, but genetically engineered plants are the only new crops for which allergenicity testing is required. In our next bulletin, we'll continue to examine whether eating genetically modified foods carries unique risks not associated with other foods.