

Do You Really Know What You're Eating? A Case Study on Genetically Modified Foods

by

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Child's Death Possibly Linked to Genetically Modified Corn*

November 12, 2001—Mitchell, South Dakota: The Linder family never anticipated their quick trip to locally owned Taco Heaven would result in tragedy. The youngest of the Linder family, 4-year-old Eric, died soon after eating tacos from the well-known neighborhood restaurant. Eric suffered an apparent allergic reaction, went into anaphylactic shock, and was unable to be resuscitated by the paramedics when they arrived on the scene.

An allergic reaction from a taco? The Linder family told reporters that Eric had no history of any food allergies and they were shocked to find that the allergic reaction was to the corn that was used to make the taco shell. The physician in the ER who examined Eric said that he had never seen a case of death from an allergic reaction to a corn product.

"It is probably due to some of that genetically modified corn that everyone has been talking about on the news as of late," says consumer activist Patricia Crowley. "They take genes from insects and bacteria and switch them around and put them in other organisms; it's a wonder we're not all dead from people playing around with our food," says Ms. Crowley.

The genetically modified corn referred to by Ms. Crowley is called Super Maize. The strain of genetically modified corn was developed by BioCrystal, a biotechnology firm located in Crisisville, Arkansas. This strain of genetically modified corn is resistant to insect pests and diseases. In this case the corn has genes from a fungus inserted into its genome, which means that it produces proteins that it would not normally be able to produce. The genetically modified corn gives farmers greater numbers of bushels of corn per acre at lower cost, thus increased productivity,

which means greater profits for the farmer. But at what cost? The Linder family would like an answer to that question.

The EPA banned the use of Super Maize corn from human food products in 1998. This was due to studies that indicated it was potentially a serious allergen to young children or those with compromised immune systems if ingested in any significant quantity. The corn was approved for use as animal feed since there were no indications of adverse effects to animals or to people who ate meat from animals fed with Super Maize corn.

Lyle Tate, a farmer in Breda, South Dakota, says he did not grow Super Maize corn, but his neighbor did. A simple test at the grain elevator to detect the presence of Super Maize corn, a test now required by the EPA, revealed Lyle's corn was contaminated by Super Maize. Farmer Tate wants to know, "How is that possible?" Lyle says he contacted his neighbor about it. "He told me the seed company that sold him the Super Maize corn seed did not inform him that he should make sure there was at least a buffer of 660 feet between the Super Maize corn and any non-biotech corn. He felt bad he had contaminated my corn." It appears that cross-pollination between corn plants permitted the transfer of the altered genome to the non-biotech corn being grown by Lyle Tate.

Eric Linder's parents are obviously very upset and want to hold everyone, from Taco Heaven to the company that produced the Super Maize seed, responsible for the death of their son. The family's lawyer could not be reached for comment but a spokesman for the family said, "On every level, everyone that allowed this harmful corn to make its way into the public food supply needs to pay. It's not about the money, it's about hurting those people in the only place they can feel pain, their pocketbook."

The lawyer for the Linder family will be holding a press conference sometime in the next few days to address plans regarding how the family will proceed.

***Note:** The above news report is fictitious; this includes all of the individuals and incidents. The events described *did not happen* and no known cases involving an allergic event such as that described have ever been documented. The article is written to encourage you to consider the topic of GMOs, but should not be read as taking a position either pro or con on the subject of whether GMOs should be produced. One of the goals of this case is for you to consider potential positive and negative benefits of GMOs. If you come to some conclusion on your position regarding GMOs after completing this case study, be sure that it is supported by good evidence and is not just an emotional response.

Group Tasks

1. Now, after having read the newspaper article, go back and note anything that you believe is in error or that you find questionable regarding facts that are stated as established truth.
2. Prepare a list of questions concerning genetically modified organisms (dealing with the science involved, not legal questions) that you would like to have answered.

Opening Statement at Press Conference by the Lawyer for the Linder Family

After speaking with scientific experts following the tragic loss of Mr. and Mrs. Linder's child, we have decided to move forward with a civil lawsuit for the wrongful death of Eric Linder. We will be filing papers today in federal district court naming Taco Heaven (the restaurant that sold the taco), Stacey Brands (manufacturer of the taco shells), BioCrystal Corporation (producer of the genetically modified corn), and the EPA as organizations liable for the death of Eric Linder. At this time we will take questions from the press.

Letter to the Editor from a Scientist at the University of South Dakota-Pierre*

November 14, 2001

Dear Editor:

I felt it imperative that I write to you to correct a number of factual errors in the article “Child’s Death Possibly Linked to Genetically Modified Corn” dated November 12, 2001. Your reporter should take the time to verify information before writing an article. This is particularly true regarding factual information pertaining to technology and recent scientific discoveries and processes.

The ER physician was correct in saying that severe allergic reactions to corn or corn products are rare though there are reports in the literature of anaphylactic reactions to maize (corn). However, the comments by Ms. Patricia Crowley seem intent on creating fear and anger among the public regarding genetically modified organisms (GMOs) by suggesting that “... it’s a wonder we’re not all dead from people playing around with our food[.]” Genetically modified organisms contain genes obtained from other species, but the procedures used to produce these GMOs are closely regulated by companies, universities, the state and federal government, and scientists themselves.

I’m not sure where your reporter obtained her facts, but she obviously failed to read the government review and approval process for Super Maize. The health safety tests found that the Cry9C protein did not resemble any known allergens though the possibility of having potential allergenicity could not be completely ruled out. Thus EPA opted to grant a split registration for Super Maize, which is not an uncommon practice for conventional pesticides. This split registration resulted because the Cry9C protein survives cooking and processing and is hard to digest. Thus, until the question of whether it could cause an allergic reaction in humans could be conclusively answered in the negative, it was felt that it should only be used for livestock feed and industrial purposes. Your reporter is mistaken when stating that “... studies ... indicated it was potentially a serious allergen to young children or those with compromised immune systems[.]”

Super Maize corn is resistant to insect pests because it contains a protein called Cry9C (called Bt protein) that is produced in the plant as a result of the presence of a gene obtained from a naturally occurring bacterium found in the soil (*Bacillus thuringiensis*). This gene was spliced into the genome of the corn using recombinant DNA techniques. This protein is deadly to worms such as the European corn borer by causing damage to their digestive system, but is completely harmless to mammals in this regard. The corn is also resistant to herbicides because of another gene inserted into the corn genome that

*Note: The above letter is part of a fictitious case study.

was obtained from another bacterium, *Streptomyces hygrosopicus*. Your reporter was incorrect in stating that Super Maize corn was resistant to diseases (refers to conditions caused by bacteria, virus, fungi) and in saying that the foreign genes inserted into the corn came from a fungus.

There is a straightforward, simple test for detection of the Bt protein using a technique called ELISA that is similar to the procedure used in a home pregnancy test. However, there is no way of telling where the corn was grown that contained the Cry9C protein which ultimately came to be present in the taco shell ingested by Eric Linder. Super Maize corn has been grown in a number of states since it was first released for use in commercial production. Mr. Lyle Tate or any other farmer cannot be sure if their corn did or did not become part of the human food chain. However, there were specific written instructions mandated by EPA that the Super Maize corn should be planted with a buffer between it and non-biotech corn. Thus, whether or not Mr. Tate's neighbor got specific instructions from the seed company about how to properly plant the Super Maize corn is not the real issue. There were instructions available to him if he took the time to read and understand them. It can be debated whether the instructions were sufficient or adequate but they were available.

It is truly a shame that young Eric Linder died, *apparently* following an allergic reaction to a taco containing a protein produced by genetically modified corn. This does not change the fact that reporters should carefully report the truth and give factual information, not as hyperbole, or myths, or lies. Also, his death does not mean that we should stop scientific progress by discontinuing the production and use of GMOs. A number of very important plants and animals have been produced using genetic engineering techniques. These organisms have in many cases proven very beneficial in improving the human condition.

Sincerely,

Paul Buckley

Paul Buckley

Paul Buckley, Ph.D.
Research Scientist and Director of the Biotechnology Center
University of South Dakota-Pierre

Research Questions for Student Groups

Each student group will be assigned one of the topics below to research in some detail and prepare a short, 10-minute PowerPoint presentation on it. They will then use their PowerPoint presentation to explain the topic to their fellow students at the next class period.

1. Provide a *brief overview* of recombinant DNA technology. What are restriction enzymes? What are plasmids?
2. Who are Stanley Cohen and Herbert Boyer and what was their role in the development of recombinant DNA technology? What was the Asilomar conference on recombinant DNA? What was the conclusion of the conference?
3. What is *Agrobacterium tumefaciens*? What is the role of this organism in production of transgenic plants? What are some current and potential applications of transgenic plants?
4. Certain government agencies play a role in regulation of the production of genetically modified plants. What are the roles of the governmental agencies, EPA (Environmental Protection Agency), FDA (Food and Drug Administration), USDA (U.S. Department of Agriculture), and APHIS (Animal and Plant Health Inspection Service) in permitting the development and growth of transgenic plants?
5. What is Bt protein? How does it act on insects? Why is it considered “safe” for ingestion by humans and animals?
6. What is an ELISA? Compare a direct versus an indirect ELISA. Provide examples of things an ELISA procedure can be used to detect. How can an ELISA be used in identifying Bt corn?
7. What is *Bacillus thuringiensis*? How is it related to other species of bacteria? Talk about the microbiology of this bacterium. Do the same for *Streptomyces hygroscopicus*.
8. What is an allergen? What are the most common food allergies? Give an overview of the typical reaction(s) to a food allergen by humans. What is anaphylactic shock? How can an allergen lead to development of anaphylactic shock?
9. “Genetically modified organisms contain genes obtained from other species, but the procedures used to produce these GMOs are closely regulated by companies, universities, the state and federal government, and scientists themselves.” This statement is from the letter written to the editor of the newspaper. How “closely” are GMOs regulated? What are the procedures used by companies, universities, and scientists to regulate production and distribution of GMOs? Compare these to those by state and federal agencies (see Question 4 above).
10. Consider the economic and health benefits of GMOs, both realized and potential. At what point would current and potential future benefits outweigh the risks? Relate the development of GMOs to other historical developments in biology that were “controversial” at the time (e.g., vaccination) and current “controversial” developments (e.g., embryonic stem cells).
11. Genetically modified animals as well as plants have been produced. Give an overview of the techniques for producing transgenic animals. What are some of the potential applications of genetically modified animals?
12. If someone is particularly interested in the legal aspects of GMOs, then the following might be appropriate questions to consider as part of a presentation. Why did the lawyers for the Linder family choose to pursue a civil rather than a criminal case? Consider levels of evidence required in civil versus criminal cases to obtain a decision of guilt or innocence. Should criminal charges be considered in this case? What is criminal negligence?

13. Have transgenic insects been produced? What technique was used to develop them? For what purpose(s) were they produced?
14. How can genes from a genetically modified plant be transferred to a plant that is not genetically modified? Can such gene transfers occur between different species of plants? What are the dangers, if any, for harm to non-pest organisms feeding on the GMO or coming in contact with the pollen of the genetically modified plant? Are there dangers of transferring genes from a genetically modified plant to a “weed” species growing nearby? Why would such an event be of concern?
15. What methods are available for detection of genetically modified crops and products? Which is most sensitive? Which has the broadest application in GMO detection and is generally accepted for regulatory purposes? Why? What is the advantage(s) of using an immunoassay, ELISA? Which is faster and more readily available for use in “field” sampling?

Homework Assignment

1. Write a letter to your congressional representative in Washington, D.C. (Senator or member of the House of Representatives). Explain why you believe genetically modified foods should be _____ as part of the American agricultural system.

(Decide if you want to argue from a pro or con perspective, insert an appropriate word in the blank space provided, and draft a letter—typed, 12-pt font, approximately 250–500 words long. Be sure to include information that shows you understand the science involved in GMOs.)

2. Write a short newspaper article telling your readers about the Linder family press conference as if you were the reporter present at the press conference. The article should be approximately 250–500 words and should cover the major points brought out during the press conference.