

Torn at the Genes: One Family's Debate Over Genetically Altered Plants

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It had been a busy day for Marsha Chamberland. She had spent most of it cleaning and running errands in preparation for her brother-in-law Ed's return, and now she was preparing a quick dinner for her family. Ed, an industry official whose job it was to decide whether or not new products needed pre-market approval by the U.S. Food and Drug Administration, had spent the last two weeks in Tennessee expressing his views on genetic engineering in food. He had attended a big conference with various members of the FDA, the Department of Health and Human Services, and business officials to determine what guidelines should be enforced regarding the regulation of transgenic foods—a controversial issue between several consumer protection groups and various government agencies. Ed was coming over later for coffee and to visit with the family.

As Marsha began dinner, she realized that in all the commotion she had forgotten to buy tomatoes for the salad. She knew that her daughter Amy would go for her, and so she called her into the kitchen. At 16, Amy had just gotten her driver's license and she jumped at the opportunity to drive anywhere, even if it was just to the grocery store.

About 10 minutes later, Amy returned and handed her mother the grocery bag. Marsha grabbed inside and pulled out a tomato.

"What's this?" she asked, as she began to read the unfamiliar label stuck on the vegetable in her hand.

"It's a tomato, Mom. The kind that Uncle Ed was talking about. The label said that it was grown special through genetic alterations so that it won't spoil or soften."

"Amy, you know how I feel about this," Marsha replied. At 45, Marsha was very conservative and had a general distrust of new technologies.

"Mom, Uncle Ed has told you over and over again that they're safe and, besides, he would want us to support him."

"Well, Uncle Ed is not your mother, is he? And I just can't accept his ideas without proof that they are safe. Now, where is my change?" Amy rummaged in her pocket and handed her mother some coins; considerably less than what Marsha was expecting.

"That's it? I gave you three dollars."

"They were \$2.99 a pound, Mom. Better quality means more money."

"That's another reason why I don't buy them, Amy. Now go get cleaned up for dinner. I guess we'll just have to have plain lettuce with dinner."

"God, Mom, you're being so old-fashioned. Genetically engineered foods are the wave of the future.

Wait until Uncle Ed comes over tonight and I'll ask him. You'll see!"

Ed arrived at the house shortly after dinner and was talking to the entire family about his trip to Tennessee. The conversation eventually turned to the business side of the trip, as Marsha had feared it would. For some reason, Ed's research had always been a bone of contention among the members of the Chamberland family. Everyone seemed to have different opinions for different reasons.

At one end of the spectrum there was Amy, who supported her uncle 100%. She wanted to see more genetically altered foods on the market, but Marsha believed that it was only because Amy thought of it as "trendy." It was the cool thing to have—next to a new car, of course.

Marsha's older daughter Karen, on the other hand, strongly opposed her uncle. A college senior, Karen was actively involved in several environmental clubs and organizations. She was against anything that posed a potential threat to the environment and had launched several protests in the past for different environmental concerns.

Marsha's son Brian, also in college, really didn't have an opinion one way or the other. He was argumentative on both sides of the issue and liked to show off his intelligence by questioning everything and everybody.

Finally, there was Marsha's husband James, who didn't really know where he stood on the issue. He wanted to be supportive of his brother but at the same time he didn't want to take sides for fear of causing further dissension within the family.

Ed began to explain several ideas that were developed during the conference regarding the regulation of genetically engineered foods. Marsha hated when the conversation turned to this, as it usually did when Ed was over.

At this point in the conversation, Amy eagerly jumped at the opportunity to disprove her mother's concerns.

"Uncle Ed, will you please tell Mom how these genetically altered plants work?"

"Well, Amy, scientists have found ways of taking a good gene, say from a bacterium, and putting it into plants such as these tomatoes or beans or corn. The bacterial gene produces a protein that makes the tomato less appetizing to a pest. Or perhaps the gene allows the tomato to survive a heavy dose of chemical spray that farmers sometimes use to control weeds in the fields. Or maybe the scientists find a gene in one species of plant and they put it into another species to help the plant survive the cold better or taste or look better."

"That's all well and good, Ed, but what about the safety issues and the cost?" asked Marsha.

"Uncle Ed, will you please tell Mom that genetically engineered fruits and vegetables are safe!" interrupted Amy. "She doesn't trust them and won't let me eat them."

"Well, safety has been a key consideration in the approval of these products, and has definitely not been overlooked. There have been over a dozen tests performed on more than 50 engineered crops to evaluate the risk and environmental impact they might have. These tests were reviewed in detail by the U.S. Department of Agriculture and they show that such engineered crops present virtually no risk to the human consumer. That's why we concluded at the conference that genetically altered foods should be subject to the same standards of regulation applied to all other foods."

"But," Marsha tried to defend herself, "there is no concrete evidence for the safety of these products. It has never been proven that they are 100% safe. As a matter of fact, I read an article the other day that said just the opposite. It said something about making bacteria resistant to antibiotics. The genes that we put into corn or tomatoes might jump into bacteria in our stomachs. Then the bacteria will suddenly have genes that make *them* resistant to antibiotics. Where would we be without useful

antibiotics?"

"Yeah," Ed replied, "that particular study was discussed and debated at the conference. What actually happens is genetic engineers have found that if they want to insert a new beneficial gene into a plant, it works better if you inject a second gene with it. The second gene is one that produces an antibiotic. It is called a marker gene because it is easy to test for its presence and see if both genes have gotten into the plant cell. In fact, the United Kingdom's Advisory Committee on Novel Foods and Processes has declared that this poses an "unacceptable risk."

Marsha nodded and smiled. She had thought for a split second that she had argued a good case, but as Ed continued to explain the process, she knew that he had a comeback for everything and that essentially it was useless to argue with him further.

Ed continued: "But after many tests this doesn't appear to be a problem. Robert Beachy, head of the Division of Plant Biology at Scripps Research Institute, has written that "there is no scientific data indicating that DNA could jump from food to a microbe in the gut of an animal." He concluded that transgenic foods pose "no risk to the public, nor to the farm animals for which they serve as food." In fact, Abigail Salyers, a microbiologist at the University of Illinois, wrote to *Nature* magazine that this is a trivial problem and that researchers ought to be more worried about the fact that we routinely put vast amounts of antibiotics in animal food and overuse antibiotics on ourselves, which creates a much more serious problem of resistance."

Brian turned to his uncle. "But, Uncle Ed, in biology we just learned about mutations and natural selection. Suppose the DNA that protects plants against insects is injected into the plants and it works? Won't the insects eventually evolve a resistance to these toxins?"

"This has been a concern and problem among farmers for many years, but mutations in the insect population are not caused just because of transgenic crops. It happens all of the time. Pests evolve a resistance even to the chemical pesticides being sprayed now. So, yes, it seems likely that the insects might evolve resistance to the toxins in the transgenic plants, since it is all caused by the operation of natural selection. Some researchers have figured out how to slow down natural selection. If farmers planted a small area of traditional crops near fields of genetically modified ones, this would significantly slow down the rate at which insects could adapt. The two different kinds of plants would exist and the insects couldn't specialize for only one."

"See, Mom, I told you there was nothing to worry about," Amy stated proudly. "Genetically altered foods are safe to eat, and plus they taste better. I'm going to go cut up that tomato right now."

Karen, who had been silent until this moment, suddenly stood up and said: "I don't know how all of you can be so naive. The safety of the nation's food supply is being threatened by an eagerness to help companies bring new products to market. Lots of companies aren't even labeling these mutant foods so that we can avoid them. That's not ethical! And on top of this we're risking ruining the whole environment. Uncle Ed may be right that bacterial toxins pose no risk to humans directly, but what happens when insect resistance spreads to populations of plants, like the forests? This would cause sharp declines in entire insect populations, which in turn would lead to declines in predators that feed on these insects, like birds. The whole cycle of life would be disrupted!"

"How is it different from the gallons of toxic fertilizers that people spray on plants now, Karen, to keep insects away? You can't tell us that that is safer," Brian argued. "At least with genetically engineered crops the only insects that are getting hurt are the pests. When you spray pesticides everywhere,

everything gets killed or poisoned."

"Brian does have a point," Ed replied. "Much of the standard agricultural and forestry practices, like the heavy use of pesticides, have severe detrimental effects on soil fertility, whereas the direct effect of genetically engineered plants on soil may be relatively small. Proteins, the products of DNA, are quickly broken down by the environment. Pesticides, on the other hand, do not break down quickly and are often harmful to beneficial insects and earthworms that are necessary to conserving a healthy soil biota. Pesticides, such as fungicides, have actually been proven to be carcinogens and account for approximately 70% of the human health problems associated with pesticide exposure. So, in general, genetic alteration methods are a lot safer than using the broad spectrum of pesticides being sprayed now."

"I never said that I was in support of chemical pesticides either," snapped Karen.

"You just don't agree with anything, Karen. And you don't even have a clue as to what you're talking about. You and your little environmental buddies just go parading around campus with your Greenpeace views arguing about everything, thinking you know what's best for the world...."

"Oh, shut up, Brian. I know what I'm talking about. I've watched National Geographic specials, and even talked to Jane Rissler, a specialist with the National Wildlife Federation, so I probably know more than you." Karen continued to argue her point, "Uncle Ed, that still doesn't explain what would happen if the genes from these "super crops" jump into other species and become "superweeds." America will be taken over by uncontrollable weeds that have an unnatural resistance to everything. Weeds will spread everywhere, even to the wildlife preserves, causing drastic declines in the native species. What then?"

Marsha looked at her husband for help. She really didn't understand her daughter's reasoning at all, but was glad that someone was on her side, even if it was for completely different reasons.

James felt his wife glaring at him and tried quickly to change the subject. He hated being stuck in the middle between the opposing views of his brother and wife. He knew eventually at some point down the road he would have to decide and take a stand on the issue. There was no getting around it. He just hoped that it wouldn't have to be anytime soon.

STUDY QUESTIONS (Be ready to discuss; these are not to be turned in).

1. What role does the FDA play in the regulation of the nation's food supply?
2. What are the regulations that the FDA enforces regarding genetically altered foods?
3. How do scientists put a gene from one organism into another?
4. What are the differences between using traditional methods of artificial selection and using various transgenic methods of altering crops?
5. What are the health risks associated with the use of genetic alterations?
6. What role do gene markers play in genetic engineering?
7. How do mutations in DNA sequences affect a species (i.e., what do mutations do)?
8. What might happen if the beneficial traits that scientists inserted into agricultural crops spread to non-agricultural settings?
9. How would the soil biota be affected by using traditional chemical pesticides and would this differ from using transgenic methods? Which method would be safer and why?
10. How might insects develop a resistance to Bt toxins? What ecological risks would this have? What could be done to combat this, and do you think that it would be effective?