Biotech In focus

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GMOs and Human Health II: Are genetically engineered foods safe to eat?

Many U.S. residents consider foods made from genetically engineered crops to be potentially harmful. Half of the respondents to a 2013 telephone poll by ABC News believed that genetically engineered foods are unsafe to eat. During the same year, three-quarters of participants in a New York Times survey expressed concerns about the safety of foods that contain GMOs, with the majority of those concerns related to human health effects.

These opinions are not shared by many health professionals or by the regulators whose job it is to protect food supplies. The American Medical Association reported in 2012 that no human health consequences from eating GMO foods have been demonstrated in the scientific literature. Likewise, GMOs are not viewed as inherently harmful by regulators in the European Union, even though the EU regulatory framework for genetically modified crops and foods is more stringent than the policies developed by U.S. agencies. The European Commission (EC) reported in 2010 that "the main conclusion to be drawn from the efforts of more than 130 research projects, covering a period of more than 25 years of research, and involving more than 500 independent research groups, is that biotechnology, and in particular GMOs, are no more risky than conventional plant breeding technologies."

It's important to note that the quote from the EC report compares the risk from GMOs to the risk from conventional crops and foods. Much of the assessment of a GMO crop is based on whether the GM food it produces is equally safe as food from a conventionally bred variety of the same crop. Is the GM food more allergenic (a topic discussed in a previous bulletin)? Is it less nutritious? Does it contain any new toxins? By reviewing tests designed to answer these questions, the FDA assesses the safety of new GMO crops on a case-by-case basis. If a transgenic protein is found to make a food significantly different, it must be labeled as a food additive. If a transgenic plant contains a new toxin or a toxin is present in higher levels than in a non-GMO crop, then it is not released.

For more information and past issues, please visit our website at www.ctahr.hawaii.edu/biotechinfocus

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Common Proteins

Some of the proteins found in transgenic crops might not sound like menu ingredients, but they have been present in conventional foods for many years. For example, Bt endotoxins are protein toxic to certain insects and produced by bacteria (Bacillus thuringiensis varieties). Bt crop plants use added bacterial genes (DNA recipes) to make these proteins. These Bt proteins are also used in environmentally friendly insecticide sprays that are approved for use on organic crops; each type of Bt protein harms only a small number of insect species and can be safely eaten by other animals. Likewise, people throughout the tropics eat the coat protein of the papaya ringspot virus when they eat fruit from infected plants; the same protein is also present in genetically modified papayas at significantly lower levels than in normally virus-infected fruits. Genetically modified papaya produce the coat protein because they contain a gene taken from the virus.

All Food Has Cells

Transgenes themselves are made out of DNA (which is found in all living cells), and are therefore designated by the FDA as Generally Recognized as Safe, or GRAS. Since nearly all unrefined foods contain cells, we eat and digest genes every day. DNA is broken down in our digestive system, and living cells have evolved ways to keep out foreign DNA.

DNA In Food Cells

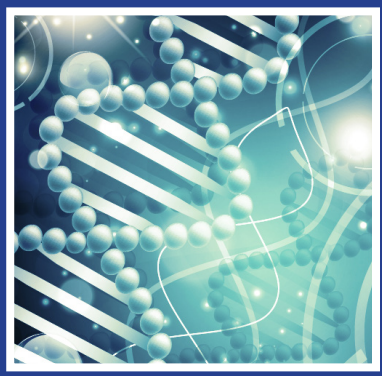
As a result, it is nearly impossible for DNA to exit food cells and enter our cells intact. You can spend a lifetime eating papaya and never have papaya genes enter your genome to make papaya proteins in your body.

Resistance Markers

Finally, many transgenes include instructions for producing a protein that makes the genetically transformed plant cells immune to a particular antibiotic. These genes, called antibiotic resistance markers, enable plant breeders to know which plant cells contain the transgene, since plant cells that don't contain the transgene die when they're treated with the antibiotic. These antibiotic resistance genes come from bacteria; can the bacteria in our digestive systems take up antibiotic resistance genes from GM foods?

The movement of transgenes from food to human gut bacteria has not been shown in feeding experiments, and most biologists consider this risk to be extremely low. This is because the DNA is broken down during the digestive process. That said, many types of bacteria can efficiently trade antibiotic resistance genes among themselves, and our guts contain trillions of bacterial cells! Bacteria in our gut can acquire new antibiotic resistance genes, but those resistance genes come from other bacteria, not from transgenic plant material that we are digesting. Nonetheless, as an extra precaution, researchers are developing new methods for selecting genetically engineered plant cells that don't require antibiotic resistance markers.

In our next bulletin, we'll look at what happened when a transgenic crop not approved for humans found its way to grocery store shelves.



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