

GMO FOOD – AN EXPERIMENT ON YOU?¹

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In the late '90s and early 2000s, genetically modified (GM) or genetically engineered (GE) crops were a hot-button issue around the world. They were originally developed by corporations such as Monsanto to increase yield by keeping crops insect-repellent and tolerant of herbicides. Companies spoke of crops that would feed impoverished countries, manufacture pharmaceuticals and clean up the environment. Critics called GMOs (Genetically Modified Organisms) a multi-pronged threat to human health, the environment, and even democracy. In the National Film Board of Canada documentary, *The Genetic Takeover*, made in 2000, the biologist and author, Arnaud Apoteker, asks, "How can we know the long-term effects when these products were only put on the market four or five years ago? I believe a handful of multinationals are conducting a health and epidemiological experiment on the whole human race." Now? Barely a peep from the populace.

Meanwhile, Monsanto, Bayer CropScience, Syngenta, and other "Ag biotech" companies have continued to create GM crops that flood the marketplace. These Ag biotech companies own over 35 percent of the international seed market. Their four largest crops, cotton, canola, soy, and corn, take up over 99 percent of GM crop land. The International Service for the Acquisition of Agri-Biotech Applications (ISAAA) claims that GMO crops cover over 282 million acres worldwide. Greenpeace says 60 percent of processed foods include some GMO. Despite decreased public interest, researchers have continued to look into the effects of GMO foods on health, some with startling results. The evidence for ill health effects caused by GM foods is limited, but so are independent studies themselves, largely due to lack of government funding. However, the startling evidence for GM health effects available, from animal experiments done since the late '90s, as well as anecdotes from around the world, suggests that GM foods can indeed have serious wide-ranging health effects.

Ann Clark, an associate professor in the Department of Plant Agriculture at Guelph University, says health issues of GM crops have emerged numerous times, starting with Arpad Pusztai in the late '90s, who was "crucified" for speaking out about his research on the health effects of GM crops on animals. The regulatory bodies "just aren't paying any attention," she says. Clark started researching GMOs on her own time in the late '90s, and has since become an outspoken critic in Canada. Jeffrey M. Smith's book, *Genetic Roulette*, published in 2007, is a painstakingly-researched account of the health effects of GM foods. Smith claims that up until 2007 there had only been about 20 independent, peer-reviewed animal feeding studies on the health effects of GM crops. That's a tiny number considering the size of the Ag biotech business and its impacts. According to Clark and Smith, the studies Ag biotech companies conducted to gain approval from governments are poor. They do not investigate long-term effects, they use dubious statistical methods, and they fail to measure many relevant factors, such as inflammatory reaction and organ damage to the test animals. In his book, Smith recounts

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several key observations and experiments that suggest GM foods indeed cause serious health effects.

Reaction to Bt Crops

Allergic reactions associated with GM Bt products have been found in humans and animals. Bt is an insecticidal protein incorporated into the genome of Bt plants by genetic engineering. In theory, Bt allows farmers to use less insecticides on their crops. In 2004 and 2005, cotton pickers in India suffered allergic reactions, some severe, to Bt cotton. They did not show this response to non-Bt cotton. These reactions have been reported in many Bt cotton workers at several cotton factories across India. Four villages also reported a quarter of their sheep died after grazing in Bt cotton fields. The crop's pollen reportedly also produced symptoms of inflammation in about 100 people in the Philippines who were living near Bt cotton fields. These people also had antibodies to Bt-toxin in their blood.

Controlled experiments have also shown negative impacts of GM Bt crops. Rats fed Monsanto's MON 863 Bt corn in a 90-day trial showed significantly increased immune cell counts and blood sugar levels, and significantly decreased kidney weight, compared to the control group. A scientist who assessed these findings for the French Commission For Biomolecular Genetics, Gilles-Eric S eralini, said that the rats' reactions were similar to those caused by pesticides. The Bt insecticide gene was also incorporated into potatoes. A study on mice compared the effects of these GM potatoes with non-GM potatoes which had Bt added to them. Results were similar between the groups, with animals from both groups displaying abnormally high cell proliferation in the intestines, as well as abnormality of cells in the intestinal lining. These effects suggest that the GM Bt potatoes may act as a carcinogen on the intestinal lining. Put together, this evidence shows that Bt products may not actually reduce the effects of pesticides on the consumer, but may be just as harmful, causing problems from serious inflammation, to toxic organ damage, to cancer.

Rats and Roundup Ready Soy

In feeding trials of GM soy, 12 female rats fed Roundup Ready soy, a GM soy crop which has herbicide tolerance genes incorporated into its genome, showed liver problems commonly associated with higher liver function. Their livers seemed to have been working harder to detoxify the effects of the GM soy compared to the rats who were fed non-GM soy. These effects mostly disappeared after researchers replaced the GM soy with non-GM soy in the rats' diets. In another experiment, mice fed Roundup Ready soy experienced reduced activity of their testicular cells. This result could have serious implications on human fertility.

In the dramatic results of a series of experiments, 25 of 45 rat offspring died after their mothers were fed GM soy prior to and during pregnancy. Compare this to three deaths out of 33 for non-GM soy-fed rats, and three out of 44 for non-soy-fed rats. Many of the organs of the GM-soy-fed offspring were much smaller than those of the non-GM groups. Even the young rats themselves were much smaller.

Other Reactions

Studies of other GM crops have suggested other health effects, including infertility, allergies, and stunted growth in young animals. Farmers in Iowa found that their pigs and cows had lower fertility coinciding with feeding of GM corn. Upswings in fertility coincided with use of non-GM

corn. Australian GM developers cancelled release of their GM peas after they triggered allergic inflammation in mice. The kidney beans that the inserted gene had come from did not produce an inflammatory reaction. It appears that the way the gene reacted with the pea genome and metabolism changed the body's reaction to the gene's protein product.

Female rats fed a version of Calgene's FlavrSavr tomato developed bleeding stomachs. Many more rats that ate FlavrSavr died during the 28-day study compared to the control group. Smith's examples of eyewitness reports and news stories are not scientific experiments, so they are inconclusive. However, they point to major health effects that GM foods might cause, leading to potentially catastrophic human health issues. At the very least, Smith's anecdotal evidence shows that the health effects of GMOs desperately need international attention, regulation, and further study. Smith writes that, in 1999, a study done on over 4000 people in the U.K. showed humans had increased allergic response to soy after GM soy was introduced into the food system.

In a more recent experiment published in 2009, Séralini and his colleagues compared the effects of three GM corn varieties on rat health over 15 weeks. The animals showed signs of exposure to toxicity in several organs, especially their livers and kidneys. The researchers proposed these organs were reacting to the toxicity of the pesticides the GM corn varieties had been modified to produce. In another twist, scientists are just beginning to investigate whether GM foods can transmit their GM genes to human gut bacteria.

The results from these animal experiments should be taken with a grain of salt when applied to humans. Our bodies are similar, but not the same, as those of rats and other lab animals. And unlike lab rats, we control our own diets. Most people eat a large variety of foods, not all of them containing genetically modified organisms. Increasing numbers of us are choosing unprocessed and organic foods that presumably don't contain GMOs. Nevertheless, the proportion of GMOs in the North American diet is high, especially for people who eat a lot of processed food. And labeling of GM foods is not mandatory in Canada, despite two private member's bills in Canadian parliament in 2001 and 2008 calling for GM food labeling. Both bills were defeated.

The Case of LY038 Corn

Recently, Renessen, a joint venture between Monsanto and Cargill, produced a high-lysine GM corn called LY038 for livestock feed. It was approved in Canada in 2006, but when the European Food Safety Authority (EFSA), the organization that recommends regulations for foods to the EU Commission, looked deeper at Monsanto's animal feeding trial and asked questions in fall 2009, Monsanto withdrew their application. Critics, including Clark, and Lucy Sharratt, coordinator of the Canadian Biotechnology Action Network (CBAN), are asking why Canada did not have the same safety concerns about Renessen's application. In an email, EFSA told Watershed Sentinel they requested the company use a different comparison corn variety than the ones used in the studies - a major change in the experiment's design that could drastically affect results. "The panel considered that the tests were not sufficient to conclude on safety and this issue needed further attention," EFSA stated. In response to why they had withdrawn the application of LY038, Monsanto told *Watershed Sentinel* in an email that they had, "Absolutely NO safety concerns whatsoever," over LY038 corn, and that they did not withdraw their application due to health concerns. "There is no reason [for withdrawal], other than Renessen's decision not to commercialize due to decreased commercial value."

Outdated Genetic Model

Clark says the Canadian government's oversight of the health implications of GMO foods is based on "an outdated and refuted view of gene function." She laughs that the Canadian government's GMO regulations treat genetics as she was taught them in school, decades earlier, when her class made necklaces with beads to mimic DNA. Genetics doesn't work like that, she says, as other scientists, and anyone who has taken an introductory genetics class, know. "We now know that when you insert a gene - when you randomly throw this thing in there, they don't know ahead of time where it's going to land," says Clark. The researchers don't know how many copies will be inserted, or what other genes it will affect, or will affect it. We now know that the position of a gene is critical to how it functions, and side effects of this are unpredictable and could be drastic, Clark and Smith both say.

Clark uses the words "ludicrous," "embarrassing," and "painful" to describe Canada's regulatory system, and calls it "a very circular, very unscientific kind of reasoning." The system relies on companies to provide their own experiments and risk assessment. To determine safety of a product, Health Canada uses a concept called substantial equivalence. "If it looks like a duck and it quacks like a duck then it's not any different than a duck," says Clark. No Canadian GM submissions have ever been rejected.

Neither is Canadian regulation transparent to the public, says Sharratt. She says the Canadian public has no say in approval of GMOs. Independent scientists can't evaluate feeding studies the Ag Biotech companies submit because they are deemed confidential. "The Canadian regulatory system is supporting the biotechnology industry ahead of the health and welfare of Canadian consumers and farmers," Sharratt says.

How does CBAN suggest Canada change? By letting the public have a say, and by introducing mechanisms to reassess a previous approval decision, says Sharratt. The consequences of the Canadian government's method of dealing with GMOs could be dire, say Sharratt and Clark. The current evidence on the negative effects GM foods have on human and animal health signals a grave need for the Canadian government to take a closer look at GM foods and how they're regulated.