The State of the Science

Most of the evidence for the safety of genetically modified food crops comes from studies that only look at short-term effects … and from information provided by the same companies who sell those seeds.

By Stuart A. Newman

When scientists first learned in the late 1970s how to sequence DNA and transfer it from one kind of organism to another, improving foods and other crop plants by introducing foreign genes was among the first applications proposed. Given contemporaneous findings in molecular genetics, such as the recognition that a mutation in a single gene could promote a cell's transformation to cancerous state,[1] it was unsurprising that concerns were raised about the capability of the transgenic methods to dramatically change the biochemistry or ecological stability of plants. Some critics suggested that the quality and safety of fruits and vegetables could be impaired, making them allergenic or toxic to humans and nonhumans who consume them, or that "superweeds" might be created which could disrupt wild or farmed ecosystems.

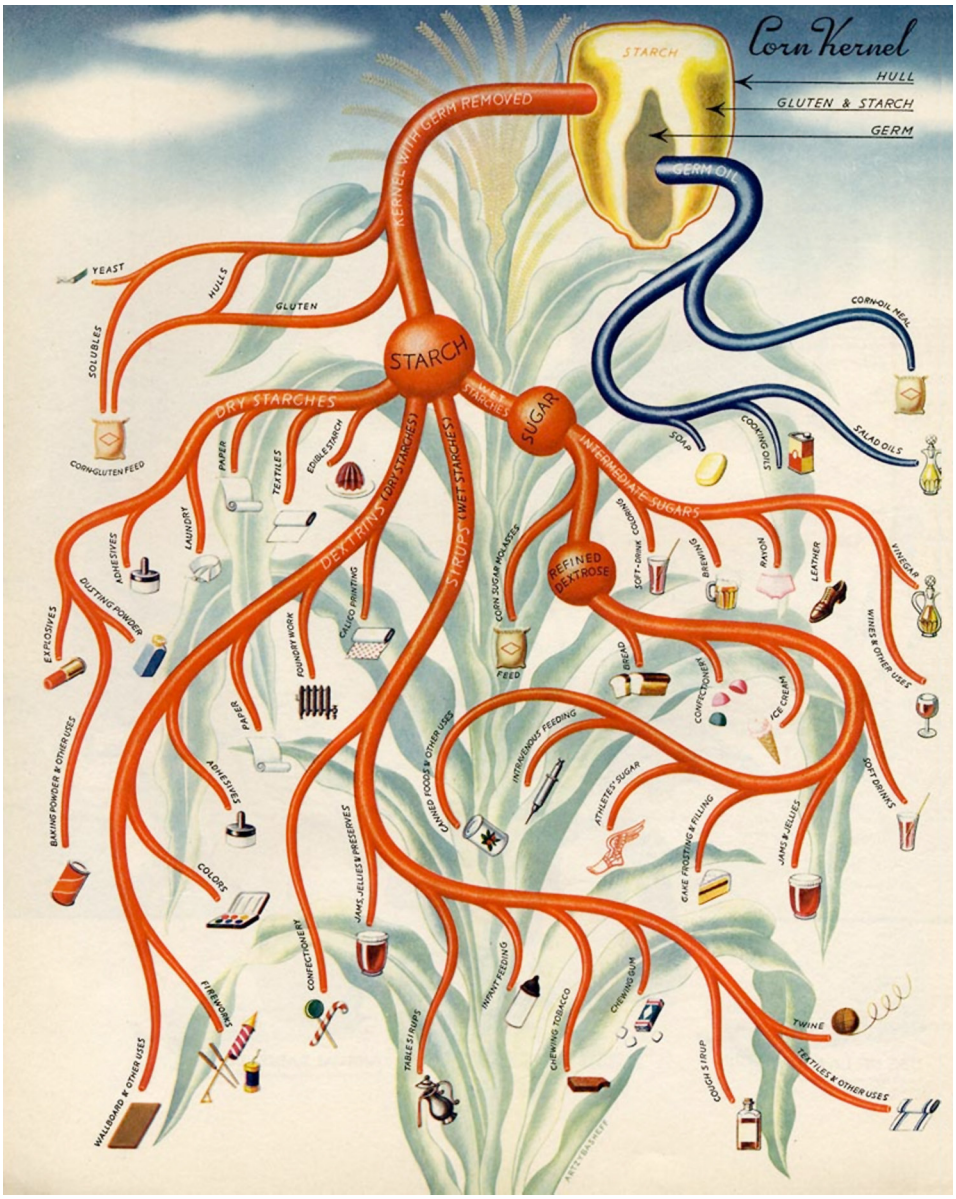

Illustration by Boris Artzybasheff for Fortune *magazine, June 1943.*

By 2005, however, when more than 90 percent of the annual soybean crop and 50 percent of the corn crop in the United States had come to be genetically engineered – a transformation in agricultural production that took less than a decade[2] – efforts at testing and regulation of genetically modified (GM) foods were increasingly portrayed as irrational. A perusal of the summaries of recent policy articles on the PubMed database turns up dozens in which reservations about the massive introduction of GM food into the food chain are represented as scientifically ignorant, economically suicidal, and cruel to the world's hungry. One abstract in the journal Nature reads: "Unjustified and impractical legal requirements are stopping genetically engineered crops from saving millions from starvation and malnutrition."[3]

These papers—many by European commentators decrying the successful efforts to keep GM foods out of the markets there, and some by U.S. commentators bemoaning

the necessity to test these products at all—mainly support their cases by referencing short-term feeding studies of animals. But this type of study is not adequate to allay valid concerns. One group, reviewing the relevant areas, has written, "It appears that there are no adverse effects of GM crops on many species of animals in acute and short-term feeding studies, but serious debates of effects of long-term and multigenerational feeding studies remain."[4]

According to another group that has looked into these issues:

> The most detailed regulatory tests on the GMOs are three-month long feeding trials of laboratory rats, which are biochemically assessed… The test data and the corresponding results are kept in secret by the companies. Our previous analyses…of three GM maize [varieties] led us to conclude that [liver and kidney] toxicities were possible, and that longer testing was necessary.[5]

Another team actually performed such long-term studies, with the findings that mice that were fed for five consecutive generations with transgenic grain resistant to a herbicide showed enlarged lymph nodes and increased white blood cells, a significant decrease in the percentage of T lymphocytes in the spleen and lymph nodes and of B lymphocytes in lymph nodes and blood in comparison to control fed for the same number of generations with conventional grain.[6]

A central issue for crop foods, of course, is their effects on humans. The most comprehensive review of this subject as of 2007 stated:

> …the genetically modified (GM) products that are currently on the international market have all passed risk assessments conducted by national authorities. These assessments have not indicated any risk to human health. In spite of this clear statement, it is quite amazing to note that the review articles published in international scientific journals during the current decade did not find, or the number was particularly small, references concerning human and animal toxicological/health risks studies on GM foods.[7]

The same group revisited the literature four years later, reporting that whereas the number of citations found in databases had dramatically increased in the intervening period, new information on products such as potatoes, cucumber, peas or tomatoes, among others was not available. Regarding corn, rice, and soybeans, there was a balance in the number of studies suggesting that GM corn and soybeans are as safe and nutritious as the respective conventional non-GM plant, and those raising still serious concerns. They also note that "most of these studies have been conducted by biotechnology companies responsible [for] commercializing these GM plants."[8]

Given the uncertainties of the long-term health impact of GM foods, it is significant that so far, virtually all genetic modification of food and fiber crops has focused on the economic aspects of production (i.e., making crops resistant to herbicides and insect damage, increasing transportability and shelf-life) rather than the more elusive goals of improving nutrition or flavor. Introducing biological qualities that enhance production, transportability and shelf life can compromise palatability, as seen with the Flavr Savr tomato, the first GM crop to be approved by the FDA for human consumption, two decades ago.[9]

To protect its investment against a skeptical public, the biotech food industry has depended on compliant regulators,[10] on its proponents' ridicule of biotech industry critics' supposed scientific ignorance,[11,12] and on expensive campaigns against labeling of prepared foods that would draw undue attention to the presence of GM components, which they claim to be natural and ordinary.[13] (These are the same components that when presented to the Patent Office and potential investors are portrayed as novel and unique.) A food crop that actually benefited the people who eat it rather than only those who sell it would likely open the floodgates of greatly weakened regulation. Golden Rice, designed to provide Vitamin A to malnourished children, has failed to overcome the hurdles for approval for dietary use since it was first described in 2000. Though very limited in its ability to alleviate malnutrition, it has some merit in the prevention of blindness, and seems poised for approval in the next year or so.[14] If so, it will almost certainly help agribusiness tighten its grip on the world food supply and increase its capacity to foist products that are much more questionable on their captive clientele—that is, everyone.

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pressreleases/Pages/Global_Tool_to_Gauge_Earths_and_Humanitys_Vital_Signs_Launches_in_Africa.aspx

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1. For more information, see the Center for Food Safety's Food Safety Review "Going Backwards: Dow's 2,4-D-Resistant Crops and a More Toxic Future." Winter 2012. http://www.centerforfoodsafety.org/wp-content/uploads/2012/02/FSR_24-D.pdf
2. Gillam, Carey. "Dow's controversial new GMO corn delayed amid protests." Reuters. January 18, 2012. Available online at http://www.reuters.com/article/2013/01/18/dow-biotech-idUSL1E9CIBN320130118
3. Darek T. R. Moreau, Corinne Conway, Ian A. Fleming. (2011) "Reproductive performance of alternative male phenotypes of growth hormone transgenic Atlantic salmon (Salmo salar)." Evolutionary Applications, Blackwell Publishing, Ltd.
4. Living Oceans Society, Media Release. "ISA virus confirmed in AquaBounty's genetically-engineered salmon." Reposted on December 20, 2012. Available at: http://www.livingoceans.org/media/releases/salmon-farming/isa-virus-confirmed-aquabounty's-genetically-engin

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1. John Gurdon, won the Nobel Prize for Medicine for his work developing the techniques now used for cloning for his work in frogs in 1962. The Scottish team's achievement was figuring out how to use this technique, previously successful only in amphibians and fish, in mammals.
2. See Center For Food Safety, "Not Ready for Prime Time: FDA's Flawed Approach to Assessing the Safety of Food from Animal Clones," March 2007, available at: http://www.centerforfoodsafety.org/pubs/FINAL_FORMATTEDprime%20time.pdf
3. See Jaydee Hanson, Comments to the US Department of Agriculture, National Organic Program on tracking animal clones using pedigrees, September 20, 2011, pgs. 253-259. Available at: http://www.ams.usda.gov/AMSv1.0/getfile?dDocName=STELPRDC5095829
4. See Melissa Del Bosque, Clone on the Range, Texas Observer, September 14, 2011 available at: http://www.texasobserver.org/clone-on-the-range-2/
5. See Daniel Boffey, "El Cardinal, the Opus Dei devotee behind cloning firm", The Daily Mail, UK, August 20, 2010 available at: http://www.dailymail.co.uk/news/article-1301215/Wisconsins-king-copy-cattle-Farmer-sold-cloned-cow-embryos-Britain-claims-fell-sales-patter-promising-prize-animal-live-ever.html#ixzz2LqRAcC3B
6. See BGI Ark Biotechnology Co. LTD Shenzen (BAB) http://www.bab-genomics.com/list.aspx?catid=168 and Christine Larson, Inside China's Genome Factory, MIT Technology Review, Feb. 11, 2013 available at http://www.technologyreview.com/featuredstory/511051/inside-chinas-genome-factory/
7. See http://www.dw.de/eu-ministers-approve-sale-of-food-from-cloned-animals-offspring/a-4414990
8. See Director General, SANCO, "Measures on animal cloning for food production in the EU" available at http://ec.europa.eu/dgs/health_consumer/dgs_consultations/animal_cloning_consultation_en.htm

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4. Ibid, p.3.
5. IAASTD (2009). Agriculture at a Crossroads. International Assessment of Agricultural Knowledge, Science and Technology for Development. Island Press, Washington, DC. http://www.agassessment.org
6. UNEP-UNCTAD Capacity-building Task Force on Trade, Environment and Development (2008). Organic Agriculture and Food Security in Africa. United Nations, New York and Geneva.
7. http://www.rodaleinstitute.org/fst30years/yields

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