

## Commentary

# The 'Future of Food' is Genetic Engineering!

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A recent Washington Post article, “The Future of Food,” discussed the methods we use to breed food crops, but the piece suffered from “pseudo-balance”: seeking out clueless commentators to contradict advocates of superior modern genetic modification techniques. We hate to break it to the author of the article (who holds a bachelor’s degree in “magazine journalism, international relations and Spanish”) but, in spite of what they teach you in journalism classes, not every issue has two sides and benefits from point-counterpoint.

Because most of society is between two and six generations removed from farming, that subject is largely terra incognita, literally and figuratively. This lack of knowledge makes the public very susceptible to fear-based marketing of food.

Humans have been modifying the DNA of our food for thousands of years. We call it *agriculture*. Early farmers (>10,000 years ago) used selective breeding to guide DNA changes in crops to better suit our needs. Approximately a hundred years ago plant breeders began using harsh chemicals and/or radiation to randomly change, or mutate, the DNA of crops. These mutagens caused innumerable changes to the DNA, none of which were characterized or examined for safety. Problems were rare. Today more than half of all food crops have mutagenesis breeding as part of their pedigree.

Ancestral varieties bear little resemblance to the domesticated crops we eat today. There are many striking pictorial examples here.

Approximately 30 years ago agricultural scientists and plant breeders began to use recombinant DNA technology (“gene splicing”) to make far more precise and predictable changes in the DNA in our crops. This

molecular genetic engineering (GE) takes a gene with a known function (e.g., toxicity to certain insect predators) and moves it into a crop to transfer the desirable trait. That enables the GE crop to protect itself from insect pests. This one trait has allowed farmers around the world to reduce broad spectrum insecticide spraying by billions of pounds. One would think environmental non-governmental organizations (eNGOs) would cheer such innovation. Sadly this is not the case; once again, no good deed goes unpunished.

Activists (many of whom are paid for their activism) have teamed up with companies that sell organic and natural food products to vilify crops crafted with molecular techniques, which have been dubbed “GMOs,” genetically modified organisms, or “Frankenfoods.” This anti-genetic engineering industry and their lobbyists are primarily responsible for the significant public apprehension towards this technology. They have been very successful generating fear towards Genetically Engineered (GE) crops (aka GMO’s) in the public. They then use that fear to sell alternative food products to unsuspecting consumers.

Now this same industry is lobbying globally for even higher regulatory barriers for gene edited crops and animals. They have had success in Europe and are now setting their sights on North America.

USDA’s 30-year-old regulatory approach to GE crops epitomizes regulation that makes no sense. It violates two fundamental rules that should dictate oversight of all products or activities: The degree of oversight should be proportional to risk, and similar things should be regulated similarly. Except for wild berries and wild mushrooms, virtually all the fruits, vegetables, and grains in our diet have been genetically improved by one technique or another, including through wide crosses, which move genes from one species or genus to another in ways that do not occur in nature. The newer molecular techniques are part of a seamless continuum, more precise and predictable extensions, or refinements, of

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earlier techniques for genetic modification, and yet, as described above, they have been singled out for hugely expensive, debilitating regulation.

The modern molecular genetic engineering techniques are neither difficult nor capital-intensive to employ, so the inflated development costs are the primary reason that more than 99% of genetically engineered crops that are cultivated today are large-scale commodity crops—corn, cotton, canola, soy, alfalfa and sugar beets. Virus-resistant Hawaiian papaya, bruise – and fungus-resistant potatoes and non-browning apples are among the few examples of genetically engineered “specialty crops” such as fruits, nuts, and vegetables.

Early concerns from the food industry about possible food contamination led to onerous USDA restrictions on the once-promising sector of “biopharming,” using genetic engineering techniques to induce crops such as corn, tomatoes, and tobacco to produce high concentrations of high-value pharmaceuticals; and that entire, once-promising, potentially important sector is now moribund. Likewise, the once high hopes for genetically engineered “biorational” microbial pesticides and microorganisms to clean up toxic wastes are dead and gone.

Not surprisingly, confronted with imposing regulatory barriers and high R&D costs, few companies or other entities are willing to invest in the development of badly needed genetically improved varieties of the subsistence crops grown in the developing world. While multinational corporate crop developers can bear these high regulatory costs for high-value, high-volume commodity grains, excessive regulation disproportionately affects small enterprises and, especially, public research endeavors, such as those at land-grant universities, which lack the necessary resources to comply with burdensome and costly regulatory requirements. Therefore, land grant universities have been put at a substantial competitive disadvantage and are no longer able either to expose their students to state-of-the-art breeding programs or to deliver important new varieties to their constituencies.

The Post article quoted perennial genetic engineering skeptic Jennifer Kuzma as saying, “We need a mandatory regulatory process: not just for scientific reasons, but for consumer and public confidence.” But thirty years of excessive regulation of GE crops have neither reduced public anxiety nor quieted the critics. If anything, these regulations have fanned public concerns about this safe, superior technology. As Barbara Keating-Edh, representing the consumer group Consumer Alert, testified before the U.S. National Biotechnology Policy Board in 1991:

For obvious reasons, the consumer views the technologies that are *most* regulated to

be the *least* safe ones. Heavy involvement by government, no matter how well intended, inevitably sends the wrong signals. Rather than ensuring confidence, it raises suspicion and doubt” [emphasis in original]. (Keating-Edh, B. Statement before the National Biotechnology Policy Board (20 September 1991), cited in Biotechnology Law Report, March-April 1993, 12 (2); 127–182.)

Now the anti-genetic engineering activists are calling for crops modified with gene editing, the newest and most precise techniques, to be lumped in with overregulated, nebulously defined “GMOs.” Unfortunately, many regulators agree. Regulators love to expand their mandates, empires and budgets.

There is a long-standing, unequivocal consensus about the continuum of genetic engineering techniques and the safety of the newer ones. As far back as 1987, a report from the U.S. National Academy of Sciences clearly stated: “There is no evidence that unique hazards exist either in the use of rDNA techniques or in the movement of genes between unrelated organisms.” And a 1989 analysis by the U.S. National Research Council concluded:

Recombinant DNA methodology makes it possible to introduce pieces of DNA, consisting of either single or multiple genes, that can be defined in function and even in nucleotide sequence. With classical techniques of gene transfer, a variable number of genes can be transferred, the number depending on the mechanism of transfer; but predicting the precise number or the traits that have been transferred is difficult, and we cannot always predict the phenotypic expression that will result. With organisms modified by molecular methods, we are in a better, if not perfect, position to predict the phenotypic expression.

And, it should be noted, the new gene editing techniques are an improvement over the decades-old recombinant DNA techniques in precision and predictability.

We have more than 20 years of data on commercialized GE crops. It is very clear GE crops are as safe, or in some cases safer than crops from other breeding methods. Putting it another way, there is no evidence that the use of molecular genetic engineering techniques confers unique or incremental risks. Even though European politicians are wary of GE crops (in large part, pandering to misguided public opinion), the views of scientists there are congruent with their counterparts in North America.

The European Academies Science Advisory Council said in 2013, “There is no valid evidence that GM crops have greater adverse impact on health and the environment than any other technology used in plant breeding.”

Even the World Health Organization of the notoriously risk-averse United Nations agrees; WHO said in a 2014 report: “GM foods currently available on the international market have passed safety assessments and are not likely to present risks for human health. In addition, no effects on human health have been shown as a result of the consumption of such foods by the general population in the countries where they have been approved.” Literally hundreds of other analyses by governmental and professional groups have echoed these findings.

Some activists have called for heightened regulations because of the fear of an “off-target edit, or an inadvertent change to a plant’s DNA.” This makes no sense, inasmuch as thousands of food crops routinely consumed today were created by chemical or irradiation mutagenesis, which introduces innumerable, uncharacterized, random mutations in DNA – and these varieties are not subject to government review and approval at all. Thus, to call for increased regulations on the most precise methods we have ever used to breed new crops defies logic and reason.

There are occasional glitches in genetic modification, to be sure, but here’s what the author of the *Washington Post* article (and especially the comments on it) miss: The newer molecular techniques for genetic modification — from recombinant DNA technology (“gene-splicing”) in the 1970’s to gene-editing now — are so much more precise and predictable that they can minimize the possibility of mishaps. Consider the example of the devastating epidemic of Southern corn leaf blight in 1970-1971, as described in a 1989 National Research Council report: It is exactly the kind of inadvertent glitch in genetic modification that is far *less* likely with the modern molecular techniques. Those who would impose *sui generis* regulation on the new techniques have it exactly *backwards*.

There’s method in their madness, however. The organic agriculture and food industries saw that modern genetic engineering techniques were transforming the gap between organic and conventional agriculture into a chasm, so they decided their only recourse was to find a way to distinguish and disparage the opposition.

In the mid-2000’s the anti-genetic engineering forces began an aggressive campaign to get food derived from GE crops to be labelled. Consumers Union’s Michael Hansen, a long-time critic of GE crops, was typically disingenuous when he said, presumably with a straight face: “I don’t understand why the companies don’t want to be labeled.” He understands very well why. His fellow-travelers have revealed the strategy. From Ronnie Cummins, the head of the Organic Consumers Association: “How – and how quickly – can we move healthy, organic products from a 4.2% market niche, to the dominant force in American food and farming? The first step is to change our labeling laws.” And from Joseph Mercola, the

purveyor of various “natural” nostrums and quack cures: “Personally, I believe GM foods must be banned entirely, but labeling is the most efficient way to achieve this.” And still more, from Andrew Kimbrell, of the Center for Food Safety: “We are going to force them to label this food. If we have it labeled, we can organize people not to buy it.”

They have had mixed success. They have failed at achieving a patchwork of state-by-state regulation, which would have created chaos in the food industry and provided a windfall for the plaintiffs’ bar to bring lawsuits for unintentional and inconsequential violations. (That prospect would have diminished the appeal of the products made with the techniques that required labeling and, therefore, discouraged the use of those techniques.)

In order to pre-empt state-by-state initiatives that threatened to create a patchwork of labeling requirements that could prove vexing and expensive for food producers, in July 2016 Congress enacted the National Bioengineered Food Disclosure Standard (NBFDS). Congress could simply have pre-empted the ability of states to create their own labeling requirements, but it went a bridge too far, by creating a federal mandate to label “bioengineered” food and delegating to USDA responsibility for fleshing out the regulation. It was published on December 21, 2018.

The statute made clear that labeling was not in any way linked to safety, which is why the rule came not from USDA food safety regulators but from the Agricultural Marketing Service (AMS). The statute clarified (Section 293) that bioengineered food “shall not be treated as safer than, or not as safe as, a non-bioengineered counterpart of the food,” thereby expressing agreement with the FDA that bioengineered foods are, in general, “substantially equivalent” to non-bioengineered foods in regard to health and safety attributes. The text of the regulation is widely considered to be incoherent gobbledygook.

It seems that consumers crave technology in every aspect of their lives except in food production. Why is that? It is because of a multi-decade, multi-national, multi-billion dollar fear-and-smear campaign against genetically engineered crops and derived foods by the anti-GMO industry.

Technology has helped to double food production in the last 50 years. We have the cheapest, safest, most abundant food supply in history, but now those who seek to increase the market for organic/natural products want to force agricultural science to an earlier, less productive time by embracing primitive, inefficient practices. Although they have been successful creating a niche for their products we cannot let them reverse the stunning scientific, economic and environmental advances that have come from genetic engineering and gene editing technology.