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Frankenfood: The Misunderstood Monster of the GMO Debate

The story of genetically modified organisms (GMOs) is one whose trajectory of development is seemingly inseparable from controversy and opposition. This decades-old debate over the application and consumption of GMOs continues to retain its fierce divisiveness across all levels of society, a characteristic that is only exasperated by the polarization of modern society. Members of the scientific community and a multitude of companies assert that GM products are the future of beneficial technology. Why then, after years of relentless research and experimentation, has objective analysis failed to bring about a resolution to this complex tangle of the GM food debate? Although the public may (or may not) inform their stances on GMOs on the vast reservoir of knowledge on the contentious technology, how they consume that information reinforces their perception of reality in ways that not only perpetuate the debate, but also blur the line between science and ideology.

Regardless of opinion, genetic modification technology represents a dramatic advancement in cutting-edge science. By engineering an organism’s DNA, scientists exercise the power to introduce or suppress certain genes with the intention of producing a desired trait in the subject. GMOs are still under development, but their present applications are far from the lab setting. In fact, roughly 75% of all products in a common grocery store contain a genetically modified (GM) ingredient. The United States, a global leader in corn production, has 94% of this
crop sourced from GM seeds (Nottingham). GM food products have been in the market for
decades. They may very well continue to be ubiquitous in the foreseeable future not because of
consumer appeal — numerous companies capitalize on their “GMO-free” labels as will be
discussed later— but because of the stated promises and potential GM seeds have to offer for
consumers and especially producers.

Genetic engineering opens a vast toolkit seed companies can tinker with to design an
ideal crop. Plants are most often genetically modified to be resistant to insects to eliminate
pesticides applications (Toke). Herbicide resistance is another common trait that would
theoretically reduce the need for chemical treatment. Multinational chemical corporations like
Monsanto and DuPont advertise their GM seeds as a cost-effective product that increases crop
yields while cutting down chemical usage, which is better for both the environment and the
farmers’ wallet. Proponents of GMOs also cite numerous other qualities that make GM crop
superior to conventional ones: drought resistance that would help strengthen the food supply in
the face of climate change, improved nutritional value that could benefit people suffering from
malnourishment or vitamin-deficiency in developing countries, and a myriad of other
possibilities. Each of these claims, however, represents a concerning negligence to the actual
capabilities and shortcomings of this polarizing technology. The debate over the reality of GMOs
and their place in society is a mosh pit of conflicting evidence, beliefs, and interests.

GMOs are controversial for a host of reasons that span a wide spectrum of grievances.
They raise practical and ethical questions that are commonly intertwined with the field of genetic
engineering, the most prominent of which fall into three contentious flashpoints: morality of the
practice, environmental repercussions, and health effects. Each flashpoint serves as a revealing
lens into the complexity of a controversial science where oversimplification and exaggeration run rampant among both pro and anti GMO camps.

As with other methods of altering DNA, GMOs face a barrage of questions about the morality of the practice itself. Should man to play the role of God by tampering with the essence of an organism? Is this another slippery slope that may lead to more than just crops and animals being genetically modified? Is mankind on a potentially disastrous trajectory by “going against the will of nature in an act of hubris?” (Blancke). Ethical questions following in this thread and the judgements they may inform are rooted in cultural, personal, and religious beliefs. While these questions about morality may play a role in our day-to-day decision making, it is interesting to observe how these questions become significantly more salient in the context of GM foods when compared to other parallels of man-made alterations to the natural order. Global warming, for example, is established to be a universal threat catalyzed by human activity, and yet the same degree of urgency found in the GMO debate fails to manifest itself in this pressing issue. A Pew study found that 49% of respondents believed climate change was a major threat but only 28% considered it a top issue (Pew). GM foods, in contrast, are subject to deep scrutiny and even outright rejection in large swaths of society and business because of conflicts with personal belief. It would be too broad a generalization, however, to say that ethical quandaries are the primary contributors to GMO resistance. Such opposition (support) is grown from a fundamental belief that the overall consequences of using GM food are worse (better) than those of conventional crops; ethics is one more rhetorical tool employed in the ongoing debate about this biotechnology.
Like these ethical concerns, the flashpoint on environmental repercussions is a facet of the controversy continually shaping the conflict. It carries an array of issues that have yet to be resolved by the scientific community, multinational corporations, and the government. One of the bigger, if not, the biggest concern regarding GMOs is the long term effects of exposing them to the environment. Stephen Nottingham, a prominent environmentalist and writer, succinctly describes the idea of modelling the future environmental impact of GMOs as “myriad and complex” (Nottingham). The lack of concrete predictions on its future implications creates a disturbing void in usable information that leaves room for judgements based on prior experiences, both positive and negative. Cross pollination of GM plants with the surrounding species is one frequently cited hazard that has had tangible effects in recent history. In 2000, a popular brand of corn called “StarLink” was found to have a gene approved for animal use, but not human consumption because it contained a toxin known to be an allergen (Nottingham). An estimated 4-5% of the entire U.S. corn crop was inadvertently contaminated by a transgenic species, forcing the Aventis company to recall its products and pay over $100 million in damages (Nottingham). Because the most recent advances in GMO technology are still in their infancy and growing, predicting future environmental consequences is as nebulous as predicting the weather in the years to come.

The inadequacy or failure of assurances from the scientific community and multinational agrochemical corporations that GM crops are guaranteed to be environmentally safe in the long term has created an exploitable gap in confidence, one that is fueled by the public’s fear of the unknown and distrust of Big Agro. Roger Beachy, an industry legend and a pioneer of genetic manipulation in agricultural technology, conducted an interview with Scientific American
in which he made a compelling case for GMOs from the perspective of one deeply involved in the field. He did, however, make one very notable deflection. When asked about the effects of GM crop genes flowing into wild ecosystems, he only stated that “Most scientists do not predict any negative consequences if the genes used to develop Golden Rice [vitamin A–rich rice] are transferred to other varieties or to wild relatives” (Borrell). Thereafter, he pivoted into a discussion about how the benefits surely outweigh the unforeseen costs, leaving the most important uncertainty untouched. While it may be true that predicting future environmental consequences is beyond his abilities, to use Golden Rice as a case study representing all of GM crops is not only a dangerous generalization, but also a disturbing disregard of situations like the StarLink incident nearly a decade before. Aventis’ recall of StarLink maize was an isolated incident in the history of GMOs, but the very existence of that enormous problem is sufficient to raise doubts among the population about environmental and health safety. The lack of information about its long term effects, combined with the fact that GM crops make up a dominant majority in certain industries feeds into that fear of the unknown that often spurs the most fervent opposition to GMOs. In lieu of further research to alleviate those concerns, agrochemical companies actively campaign on other promises GM crops have to offer.

One redeeming trait GM seed manufacturers advertise is the reduction of pesticide and herbicide usage with these crops that are engineered to either resist pests or the chemicals applied to them. Dr. Matin Qaim, a German researcher at Georg-August University and a frequently cited source by Monsanto, found “significant effects mostly from insect-resistant varieties in the developing world” (Hakim). A sample of farmers in China who used crops engineered wit B.t. (bacillus thuringiensis), a strain of bacterial genes that improved insect
resistance, helped farmers increase their yield while reducing pesticide usage by 25% — a very promising percentage attesting to the potential of GMOs (Nottingham). Dr. Qaim was quick to note, however, that “currently available GM crops would not lead to major yield gains in Europe” because agriculture in developed countries already operates on a technologically advanced level to begin with; GMOs only provide marginal improvements to that. The New York Times reported that the US hasn’t had a significant increase in yields over France, a country restrictive of GMOs (Hakim). The fact that the US lags behind France in overall herbicide reduction contradicts the information and claims supplied by these large companies. A possible explanation lies in how herbicide tolerance traits in crops may actually encourage more liberal applications of the chemicals to control weeds (Nottingham). This simultaneously cancels out the intended chemical reductions and strengthens the tolerance of weeds to herbicides. The obvious consequence is heavier or more toxic treatments (Toke). An interesting, yet concerning side note is that the herbicides used by farmers tend to be sold to them by the powerful entities producing the GM seeds. As weeds become increasingly tolerant to herbicides, corporations like Monsanto can capitalize on it by selling more of their product in an alarming cycle of profit that has been at the core of many a protest over the years. While the claims of chemical reductions by GMOs hold true in specific scenarios around the globe, companies continue to inflate the actual potential their products when marketing, further perturbing the opponents who question the actual effectiveness of the technology.

Although the major concerns regarding GM crops over environmental impact and corporate involvement are certainly significant in the broader debate, these issues tend to be less about the technology than its application. Resistance management and careful chemical
treatments are essential for minimizing the herbicide and pesticide application issues that would invariably arise with conventional crops and herbicides. When it comes to the role of Big Agro, it is worth noting that their powerful and, at times, controversial influence has other parallels in other industries, like ExxonMobil in petroleum and Nestle in food product. Why then do GMOs producers receive a disproportionate amount of flak for their power over the food economy? The most probable rationale lies in a fundamental opposition to this genetic engineering technology as a whole, with the aforementioned problematic practices serving as common reasons to blame. NYT journalist Danny Hakim, in his piece holding weighing the promises of GMOs to their lackluster results, observed that “these [environmental] issues have to do with how GM technology is sometimes applied and certainly do not warrant resistance to the technology and to GMOs in general” (Hakim). Reasons for resistance vary across the spectrum, but a running theme throughout when it comes to criticism is a concern for its repercussions on the status quo from a social, environmental, and economic standpoint. With such polarized opinion comes a natural tendency in the debate to make the facts and science vulnerable to the intensifying forces of ideology.

Of all the concerns, the health effects of GMOs should in theory be the least controversial. Investigation after investigation has proven that GM foods designed for consumption are as safe to eat as their conventional counterparts (Charles). Yet, a Pew study found that one in three adults in the U.S. believe GMOs are worse for health. Even as “fears about the harmful effects of eating G.M. foods have proved to be largely without scientific basis,” health hazards are among the most cited reasons consumers choose to avoid them (Hakim). Critics may assert that there is no such agreement, as illustrated when the activist
organization Greenpeace published a statement signed by 300 scientists and legal experts that stated a scientific consensus on GMO safety did not exist. In response, Mark Lynas of the Cornell University Alliance for Science retorted that “That sounds like a lot, until you compare it with the 30,000 American scientists who have… signed a petition claiming that there is ‘no convincing scientific evidence’ linking CO2 with climate change” even as the general consensus points otherwise (Lynas). Why then, is a significant portion of America convinced GMOs are hazardous?

A number of theories arise to explain this counterintuitive behaviour putting the public and the scientists at odds. One possible explanation lies in the theory of psychological essentialism, which is the belief that DNA is the unperceivable, fundamental “essence” of an organism’s identity (Hakim). As a result, people believe that engineering certain traits from one organism causes those characteristics to arise in the transgenic species. An opinion survey relevant to this concept showed that half of American respondents say that a tomato containing fish DNA would taste like fish. While this example may seem harmless, it can become a problematic notion in other cases of genetic engineering, such as E. coli genes in certain GM products. One’s first instinct would be to blame this false belief on a pervasive lack of education in the public sphere. This, however, may not actually be the reason behind anti-GMO sentiments.

Delving beyond education when analyzing the resistance against GM food reveals a less tangible but remarkably powerful force: preexisting beliefs. A study published by investigators at the Pew Research Center discovered that adults who say they have heard a lot about GMOs were more likely to believe that GM food is worse for health than conventional products (Funk & Kennedy). This appears to debunk the myth that more education correlates to greater support.
The National Academy of Science validated these findings through a case study of climate change. Despite the scientific consensus that global warming is an existential threat catalyzed by mankind, acceptance of the issue is clearly divided over political lines, with liberals exhibiting more concern than their conservative counterparts (Roundtable on Public Interfaces of the Life Sciences). Political parties are defined by their differences in ideology, and the climate change case study is a prime example of how ideological division erects distinct lenses to view the world. It would be naive, however, to say that education is irrelevant in this issue. Professor Brandon McFadden of the University of Florida reported that those tested to have a higher actual knowledge of GMOs (not perceived) demonstrated greater support for the technology. This finding suggests that people are not consuming information the uniformly. In both GMOs and climate change, why then does the deep reservoir of raw data and scientific information fail to resolve this polarized debate with objective facts?

Personal beliefs and distinct worldviews are compelling psychological forces that actively sway the controversy away from any sort of consensus. Motivated reasoning and confirmation bias —weighing information that fits one’s beliefs more heavily than that which contradicts them— are natural consequences of these human tendencies. These concepts help “explain why the same piece of scientific information can have different meanings to different people and in turn produce different outcomes” (Roundtable on Public…). Achieving a common ground in the debate is therefore impossible so long as separate interpretations of reality exist to perpetuate it. The effect of confirmation bias in the process of digesting information is a quantifiably clear rift between science in society. Of the U.S. adults polled, 35% indicated that scientists had little understanding into the health effects of GM foods (Funk & Kennedy). This
statistic is concerning because it implies that (1) a large number of people do not trust the analysis of scientists heavily involved in the field and (2) there exists a widespread belief that the information the public is presented is tainted with bias. That gap in confidence and perceived void in reliable facts creates a demand for information that bolsters the existing structure of beliefs one may have, even if that structure’s foundation is incompatible with the science.

The public awareness campaigns of both sides of the GMO debate present an enlightening opportunity to analyze the effectiveness of certain techniques on swaying opinion. Throughout the 1990’s and well into recent years, large agrochemical companies have poured millions of dollars into an intense PR campaigns to improve the image of their GM products in the face of a vocal, growing anti-GMO movement. These campaigns, however, have been far less successful than anticipated. Early efforts were centered around pumping out positive evidence into the public light and heavy-handedly dismissing the opposition as anti-science and irrational (Falkner). The scientific studies used were not done by independent sources or reviewed by non-industry scientists, drawing intense skepticism and solidifying a general mistrust in those companies’ logos heavy PR efforts. Corporations like Monsanto actively dismissed critics as irrational, effectively alienating their audience. Robert Falkner, a lecturer at the London School of Economics and Political Science, described how “Monsanto’s heavy-handed tactics only served to strengthen consumer hostility and turned the GMO controversy into a David versus Goliath-type contest between civil society and big business” (Falkner). The anti-GMO side has had significantly more success at a fraction of the cost in persuading the public GMOs are a threat. The basis of the opposition argument frequently seeks to evoke an emotive response with ethos and pathos dense rationales. Because of these compelling outreach methods, the ideas they
present are “easily processed and remembered and thus stand a greater chance of being transmitted and becoming popular, even if they are untrue” (Blancke). The cloud of unpopularity achieved by years of anti-GM food campaigning spurred prominent businesses like Chipotle and Ben & Jerry’s to advertise their products as GMO-free, thereby perpetuating the cycle of unpopularity for the technology. The difference in marketing by pro and anti-GMO groups has had striking repercussions not only in consumers’ understanding of GMOs but also science informing those beliefs.

Scientific evidence is supplied by groups to reinforce the consumers’ induced confirmation bias despite numerous instances of shady experimental practices or exaggerated results. Because both sides of the debate require a scientific basis as the backbone their assertions, corporations and lobbying groups alike are leveraging the credibility of academia to supply the public with information compatible with their interests (Lipton). Monsanto, for example, has aggressively recruited professors and researchers from universities by providing unrestricted financial aid for projects and company-funded trips to Washington D.C. to lobby in the Capitol (Lipton). This practice is problematic on multiple levels. Naturally, corporations and special interest groups would not fund research endeavors with finding counter to their cause. The implication is that some scientists receiving funds are shaping their findings to conform to the specifications of their funder. This scenario falls into a disturbing reality described by University of Birmingham lecturer David Toke that “normal science...seems an attempt to force nature into the preformed and relatively inflexible box that the paradigm provides” (Toke). This observation marks a notable departure of the institution of science from its definition as a systematic, unbiased process of investigating processes and phenomena. The turbulent GMO
debate has become a litmus test for the sanctity of science in the modern age of information, polarization, and politicization.

If it is true that science is susceptible to the influences of ideology, then the classical definition of the discipline fails to capture the complex role of science in the broader web of society. According to David Toke, “science itself cannot be divorced from cultural, social, and political interferences” (Toke). It is important to recognize that all data, analysis, and research is conducted by scientists—humans—who “are imbued with a distinctive set of attitudes about issues of controversy on agricultural biotechnology” (Toke). While these scientists do have the free will to incorporate or distance their personal beliefs when conducting research, the influence of these “attitudes” as discussed by Toke remains a powerful component of the psyche directing the forces of confirmation bias and motivated reasoning to make culturally sensible judgments on experiment results even if other viable interpretations exist. This is not to say their findings are inaccurate across the board; the information they discover is generally in agreement with an existing scientific theory or hypothesis, or in certain cases as illustrated by the GMO debate, ideology and beliefs as well. In the same way culture influences science, science exerts a unique influence over culture as well. Researchers are “necessary contributors to deciding the social truths of the day” due to their perceived credibility—a credibility that wavers only in scenarios involving controversial topics like GMOs, global warming, or vaccines because of ideological conflicts (Toke). When such conflicts arise, precedence is given to ideological beliefs due to its aforementioned rigidity. The current application of science in this polarized society is therefore a subjectively objective tool, a way to introduce research and raw data such that it supports a particular narrative.
The GMO debate, its contrasting scientific findings, and the feedback loop of information and misinformation represent a chaotic intersection of science and ideology. What should in theory be a question settled by data and facts has persisted as a heavily ideological mosh pit of conflicting findings and personal beliefs. Using the GMO controversy serving as a lens to understand the interactions of cutting-edge technology and society, a disturbing trend emerges for the institution of science as a whole. The independence of science and bias is evolving into a mere line in the sand, one that becomes fainter and fainter with each wave of ideological backlash and controversy. How society addresses rampant polarization in the public conscience decides not only the progression of culture in today’s age of information, but also the future of contentious technology to come.
Works Cited


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