Cultural War over Genetic Engineering

The debate surrounding the dangers posed by genetically modified organisms is becoming emotional and increasingly removed from the scientific context – particularly when it comes to the use of these organisms in agriculture. The radical rejection is obstructing its development and leading to problems that its opponents had actually hoped to prevent. In our author's view, it is therefore time to start the debate anew.

TEXT **DIETHARD TAUTZ**

A recent commentary in the features pages of the German daily Süddeutsche Zeitung on the cultural differences between Germans and Americans stated: "There is the unsettling feeling that this country we love so much (Manhattan, Dylan, Philip Roth), is ultimately very strange (genetically modified food, Wall Street, George W. Bush)." How on earth did we reach the point where genetically modified food became a cultural difference between Europeans and Americans?

A legislative initiative proposing the labeling of food produced using genetically modified ingredients was actually rejected by the majority of voters in California. Why is genetic engineering associated in our minds with a sense of danger that, particularly in the case of food, can rapidly assume emotional proportions? The debate surrounding genetic engineering really does appear to remain stuck in the extreme positions that emerged in the 1980s. These were shaped mainly by the active conflicts surrounding the hazards of nuclear technology, and augmented by topics of general social concern.

Today's debate is shaped by previous extreme positions

In a very detailed analysis dating as far back as 1988, historian Joachim Radkau wrote: "The opposition to genetic engineering is based only in part on the feared deficits in technical safety and more on the concern that, even if it didn't pose any current threat, the success of molecular biology would give new impetus to unsettling tendencies: the manipulative treatment of nature; the breeding of monocultures that rely on the extensive use of herbicides; drug-driven medicine; the patronizing of women; the replacement of environmental and social policy with selection, with the aim of creating the optimally adapted human. These concerns about the future were driven, not least, by a look back at past events." >

Hard fronts: The debate between opponents and advocates of genetic engineering is also inflamed by products such as *Golden Rice* (right). Researchers created this variety with the aim of reducing the high rate of infant mortality – caused by a vitamin A deficiency – among children in developing countries. The rice gets its golden color from a precursor of vitamin A in the grains.

Photo: Kai Weinsziehr

Thus, the debate surrounding the dangers associated with genetic engineering was ultimately only a substitute for a smorgasbord of entirely different societal problems. Despite the fact that it was never really applicable, the comparison with nuclear power was a particularly forceful argument. Although radioactive substances pose a real and quantifiable risk against which we must protect ourselves using technical measures, genetic engineering in itself poses no risk. Genes are not toxic, either in their natural or in a newly combined form.

Natural gene transfer between species is a regular occurrence

When the basic principles of genetic engineering methodology took shape in the early 1970s, the scientists involved had misgivings as to whether it might lead to the unintentional combining of different genetic material and result in the formation of dangerous new organisms. When it became possible to infiltrate the genome of infectious viruses into bacteria, it was decided to organize a moratorium and stage a conference on future safety guidelines.

The conference was held in Asilomar, California in early 1975. Genetic engineering was defined at the time as a methodology whereby nucleic acids from different species are combined and infiltrated into organisms that are capable of reproduction. In addition, general guidelines were defined for safety measures that, years later, were incorporated into the legislation of many states.

Almost 40 years have since passed, and considerable progress has been made. In retrospect, the original concerns that led to the moratorium proved unfounded. For example, we now know that the combining of genetic material from different organisms is a completely natural process: the natural transfer of genes between species is a regular occurrence in microorganisms, fungi and even higher organisms.

Moreover, today we know that viruses that infect higher organisms can't become active in bacteria. Indeed, up to now, there has not been a single accident involving genetic engineering, despite the fact that thousands of laboratories now work with this technology on a daily basis.

For this reason, the critics of genetic engineering conjured up fictitious disaster scenarios as possible hazards, such as the uncontrolled release of a new infectious bacterium, virus or even an animal or plant species that could cause ecological damage. This has resulted in the widely held belief that genetic engineering is more dangerous than nuclear power, as the release of such organisms is believed to be irreversible.

However, infectious bacteria and viruses have always been part of our natural environment. Similarly, particularly in recent decades, animals and plants have constantly spread in areas in which they did not previously exist. These threats are thus real, but they aren't new. For example, we need to focus intensively on the problem posed by the natural emergence of antibiotic resistance. Compared to this, the dangers associated with a genetic accident are negligible.

The debate surrounding genetic engineering has many dimensions. On the one hand, the fact that processes and products based on genetic engineering have long completed the transition into everyday life is almost always ignored. These applications include drugs, such as insulin, and enzymes in detergents that can clean effectively at low temperatures and have resulted in the demise of washing at very high temperatures. Therefore, genetically engineered products can be found in every household. On the other hand, the conflict surrounding genetically modified food has attained the aforementioned cultural dimension, in the context of which scientific arguments are almost completely redundant.

This is also demonstrated by the huge media response to a long-term study published by French scientists in fall 2012. In this case, the researchers came to the erroneous conclusion that rats developed cancer far more frequently when they were fed with genetically modified corn. The report and the accompanying films immediately made the headlines and evening news bulletins without undergoing any critical analysis.

In fact, the French scientists had used a rat strain that is not suitable for longitudinal studies, as these animals suffer from a naturally high rate of cancer in advanced age. Moreover, the researchers violated

basic statistical rules regarding the research design and interpreted their data incorrectly.

One day later, statements were published by independent scientists who drew attention to the serious weaknesses of the study – but it was already too late. It eventually emerged that the research had been funded by an anti-genetic-engineering organization and that the author of the studies needed media attention for a new book.

In reality, the genetically modified food debate is, for the most part, no longer concerned with scientific issues, but with secondary issues like the market power of corporations. Therefore, the conflict surrounding genetic engineering in agriculture has long developed into a row about the role of large corporations in food production. Curiously, the fundamental opposition to genetic engineering in agriculture tends to result in it being supported exclusively by big corporations, as smaller companies and non-profit initiatives are overwhelmed by the resistance and regulatory requirements. This hinders the development of a free market.

Organic farming is idealized as the alternative model, on the basis of which farmers can grow what they decide is the right thing to grow, and generate their own seed material and remain free from the influence of the corporations. However, irrespective of genetic engineering, the corporations have created monopolies for themselves through traditional breeding practices, which force farmers to buy new seed from them every year.

Hybrids of many crops are cultivated, particularly corn, for which the seed has to be newly created for each generation through special crossbreeds. The hybrids from two lines can provide considerably higher yields, and the corporations have been optimizing this process for decades to safeguard their own business.

Theoretically, higher harvest yields can also be obtained through pure breeding lines. Consequently, varieties could be created with the help of genetic engineering measures that are not reliant on these hybrids. These varieties would generate high yields and the seed could be set aside from the harvest. However, the opposition to genetic engineering in agriculture aims to prevent the cultivation of such varieties, or to ensure that the cost of their introduction would be too high for small concerns.

Could it be that the big corporations are themselves interested in maintaining the resistance to genetic engineering in agriculture so that they can ward off competition and new developments? Some of the changes targeted by genetic engineering can now also be achieved at the same cost using traditional breeding methods. This includes the generation of mutants using radioactive irradiation. And here we have yet another irrational turn in the debate: the use of genetic engineering is considered dangerous, while the use of nuclear technology is "traditional."

As a result, we find ourselves in a curious situation, particularly in relation to herbicide-resistant varieties: the opponents of genetic engineering have always specifically branded such varieties as a particularly extreme aberration arising from genetic engineering in agriculture – and accordingly have more or less blocked its introduction in Europe.

However, herbicide-resistant varieties produced using traditional breeding techniques have since become available on the market under the product name "Clearfield," and are practically unregulated – despite the fact that all of the follow-up problems regarding herbicide use and the spread of resistance to other plants are just as relevant to these varieties as they are to the genetically modified ones. The risk debate surrounding genetic engineering continues here ad absurdum.

Many of the feared risks also affect traditional breeding processes

The row about the development and introduction of *Golden Rice* is a particularly illustrative example of how irrational the debate surrounding genetic engineering in agriculture has long since become. These genetically modified rice plants were developed by scientists with the aim of reducing the high rate of infant mortality – caused by a vitamin A deficiency – among children in developing countries.

Such rice varieties could already be cultivated today. Small farmers wouldn't have to pay any license fees for them and they would save the lives and

Photo: Kai Weinsziehr

health of many children. However, due to the huge bureaucratic obstacles and the opposition of environmental organizations, it remains uncertain whether they will ever be cultivated on a large scale.

The organization foodwatch comments on this situation as follows: "The humanitarian motivation of the makers of *Golden Rice* is tainted by the association with a campaign that aims to bring about a breakthrough for genetically modified food by presenting it as the only means of overcoming malnutrition. This project is intended to simultaneously improve the image of genetic engineering, lower the standards for risk assessment and put the critics of genetically modified food under moral pressure." Since – clearly – no further arguments can be found for presenting genetic engineering in itself as dangerous, substitute arguments are now being introduced that have nothing to do with the issue itself.

A unique situation in the context of rule of law, whereby the legislator regulates something it doesn't see as posing any risk

However, developments involving genetic engineering that aren't in tune with the times have even occurred outside of agriculture. Legislative requirements relating to the management of genetic engineering emerged from the recommendations of the aforementioned Asilomar conference. For instance, four safety levels were introduced, labeled S1 to S4. These regulate mainly the management of organisms that present known risks, such as infectious bacteria and viruses.

According to the German Genetic Engineering Act, for example, the lowest safety level S1 is to be applied to "genetic engineering operations that, according to current scientific knowledge, do not involve any risk to human health and the environment." Nonetheless, these operations are subject to strict regulation and monitoring by the authorities. Because most genetic engineering operations arise in this category, a major bureaucratic superstructure has emerged. Billions in investments are needed to fulfill requirements that offer no additional safety. What we have here is a unique situation in the context of the rule of law, whereby the legislator regulates something that it doesn't see as posing any risk.

In my view, a new debate about genetic engineering based on up-to-date knowledge is long overdue. If the current deadlock in the public debate isn't overcome, we will also hinder development not only in agriculture and science, but also in very different areas. For example, the conversion of our economy from one based on the consumption of fossil fuels to one that relies on renewable resources – the so-called bio-economy – could benefit hugely from genetic engineering.

At the latest, the 40th anniversary of the Asilomar conference in 2015 would offer a fitting opportunity for resuming the debate. A modern society can't afford this irrational cultural war over genetic engineering. ◀

THE AUTHOR

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