

- INNOVATION
- POLITICS
- GENETICS
- NEUROSCIENCE
- CREATIVITY
- ECOLOGY
- COMMUNICATION
- PUBLIC PERCEPTION
- SCALE
- DEVELOPMENT
- COGNITION
- ENERGY
- DATA
- TRUTH
- DECISION MAKING
- MEDICINE
- DESIGN
- FOOD
- BIOTECHNOLOGY
- COOPERATION
- DISEASE
- SOCIAL SCIENCE
- COMPLEXITY
- INFORMATION
- GOVERNANCE
- DNA
- ENVIRONMENT
- FUNDING
- SYSTEMS
- LEADERSHIP
- GLOBAL RESET
- RISK
- BIAS
- COMPETITION
- LIMITS
- INTELLIGENCE
- SCIART
- EDUCATION
- LAW
- IDENTITY
- POPULATION
- PROOF
- MEDIA
- GROWTH
- ENGINEERING
- TIME
- ECONOMICS
- HAPPINESS
- BIOLOGY
- GEOGRAPHY
- COMMUNITY
- MATH
- LITERACY
- CONSENSUS
- RESILIENCE
- NETWORKS
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- ETHICS
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FIVE EXPERTS DEBATE THE ROOTS OF OPPOSITION, THE ROLE OF BIG AGRIBUSINESS, AND WHETHER WE'VE ACHIEVED REAL SCIENTIFIC CONSENSUS.

Scientific Flip-Flop
 ANALYSIS BY PAVLA MONTENEGRO

PRINT SHARETHIS

On April 22, 1998 the European Union contravened decades of stalwart opposition to genetically engineered crops when it greenlighted the cultivation of “Mon 810,” a pest-resistant maize manufactured by Monsanto.



But despite Mon810’s official sanction under EU law, several countries—including France, Austria, Greece, Hungary and Luxembourg—have imposed national bans on the GE crop. The most recent addition to this list is Germany, which banned the corn in April, just before this year’s seeds would have been sown.

Why the opposition to genetic engineering? Our Panel Responds:

- ▶ **Pamela Ronald**, plant geneticist
- ▶ **Raj Patel**, writer and activist
- ▶ **Nina Fedoroff**, science and technology adviser to the US Secretary of State
- ▶ **Tom Philpott**, food writer, farmer, and cook
- ▶ **Noel Kingsbury**, horticulturalist and writer

Ilse Aigner, Germany’s federal agricultural minister, acknowledged that various federal environmental institutes had failed to come to an agreement about Mon810’s environmental risks, but said she was encouraged by the example of Luxembourg, which imposed a moratorium in late March.2

At the European level, scientific assessments have found the risks Mon810 poses to the environment to be exceedingly small. Which is no surprise, perhaps, since [study](#) after [study](#) after [study](#) has concluded that the hazards—both to human and ecosystem health—are no greater with GE crops than with conventionally grown ones.

And yet throughout Europe, public opinion appears to be turning increasingly against GE crops. Speaking on condition of anonymity, one source told *EUbusiness* that if the people were asked about Mon810, “there would be a rejection.” “The spirit has changed,” the source added. “The legislation in a way is operating like an automatic pilot and we have to put some direction in it.”

Most Europeans don’t consider themselves to be anti-science or particularly technophobic. In fact, Europe’s full embrace of the scientific consensus on another environmental issue, global warming, has enabled the continent to take the clear lead on climate change, with the most ambitious emissions targets, the first carbon trading market, and the greenest urban infrastructure plans on the planet.

Europe’s scientific disconnect is more broadly true of eco-minded citizens worldwide: They laud the likes of James Hansen and Rajendra Pachauri but shrink in horror at the scientist who offers up a Bt corn plant (even though numerous [studies](#) indicate that Bt crops—by dramatically curbing pesticide use—conserve biodiversity on farms and reduce chemical-related sickness among farmers).

So why the disconnect? Why do many environmentalists trust science when it comes to climate change but not when it comes to genetic engineering? Is the fear really about the technology itself or is it a mistrust of big agribusiness?

Parsing Between Corporations and Science

Pamela Ronald is a professor of plant pathology at the University of California, Davis, where she studies the role that genes play in a plant’s

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response to its environment. She is co-author of Tomorrow's Table: Organic Farming, Genetics, and the Future of Food.

The community of Davis, California, where I teach, is renowned for its devotion to the idea of local, organic, sustainable foods. As a plant geneticist, I spend my weekdays doing research, surrounded mostly by scientists (some who admit being baffled by continued fears about GM food). As the wife of an organic farmer, I spend my weekends gardening and cooking the produce that my husband, Raoul, brings in from the farm. My lab focuses on genetically engineering rice to give it resistance to diseases and flooding, both of which are serious problems of rice crops in Africa and Asia. My family focuses, at least in the summertime, on eating lots of pesto, which we make by grinding up organic basil from Raoul's farm with the organic walnuts our neighbor gives us. In short, my world is a case study in contrasts, and it's given me an insider's view of perspectives from both communities.

My overwhelming sense is that public skepticism about GM crops, and the foods derived from them, is not about the science—it is about US corporations. Some consumers have not forgotten that Monsanto was a producer of Agent Orange for the US military during the Vietnam War. Others worry that corporations will control the global seed supply.

Still, consumers—whether in Davis or Düsseldorf—need to distinguish between a scientific process (genetic engineering) and corporations. The misdirected protests are an unfortunate diversion from the obvious: We need to feed more people on less land with less water and do it in a way that reduces environmentally harmful inputs. This is a critical environmental issue of our time.

Just consider the case of China: Beginning in 1997, an important change swept over cotton farms in the northern part of the country. By adopting new farming techniques, growers found they could spray far less insecticide over their fields. Within four years they had reduced their annual use of the poisonous chemicals by 156 million pounds—almost as much as is used in the entire state of California each year. Cotton yields in the region climbed, and production costs fell. Strikingly, the number of insecticide-related illnesses among farmers in the region dropped to a quarter of their previous level.

This story, which has been repeated around the world, is precisely the kind of triumph over chemicals that organic-farming advocates wish for. But the hero in this story isn't organic farming. It is genetic engineering.

The most important change embraced by the Chinese farmers was to use a variety of cotton genetically engineered to protect itself against insects. The plants carry a protein called Bt, a favorite insecticide of organic farmers because it kills pests but is nontoxic to mammals, birds, fish, and humans. By 2001, Bt cotton accounted for nearly half the cotton produced in China.

For anyone worried about the future of global agriculture, the story is instructive. With 300,000 people dying each year globally from pesticide poisoning and a predicted 9.2 billion people to feed by 2050, you would think Europeans would be hungering for safe strategies to transform our agriculture into productive, biologically-based systems.

That they are not suggests that they have forgotten the broader goals of a sustainable agriculture: to maximize the health of the environment, the farmer, and the consumer. Legislating against a benign genetic process will not create the transformative changes we need on our farms.



Don't Label Us Anti-Science

Raj Patel is a writer, activist, and academic. He is currently a visiting scholar at UC Berkeley's Center for African Studies and an honorary research fellow at the School of Development Studies at the University of KwaZulu-Natal. His first book is Stuffed and Starved: The Hidden Battle for the World Food System.

It's rather tiring to be characterized as anti-science. Every activist I know who's concerned about social and environmental justice has a healthy respect for the traditions and ideals of scientific enquiry. Consider, for instance, Robert

Watson's chairing of the Intergovernmental Panel on Climate Change from 1997 to 2002. When he fought through the fossil fuel industry's smoke and mirrors to present his findings, environmentalists applauded.

After that success, Watson, in his role as the World Bank's Chief Scientist, assembled a panel of more than 400 scientists to ask how the world would feed itself in 2050. The project was the International Assessment of Agricultural Knowledge, Science, and Technology for Development, which, after five wide-ranging years of consultation and research, recently presented its conclusions.

The answer that IAASTD came up with was that, after billions of dollars already spent, the promise of genetically modified (GM) crops remained unfulfilled. Answers to future global hunger will need locality-specific, carbon-sequestering, fossil-fuel-free and water-frugal solutions. Environmentalists applauded that, too.

So where did the anti-science chorus come from? Governments and the private sector. To date, the US has refused to countenance these scientific conclusions, and I've seen representatives from the agribusiness Syngenta froth at the mouth at IAASTD's mention.

This points to my concerns about the state of scientific debate. The direction of research priorities in agriculture is predominantly shaped not by the relative merit of different technologies, but rather the research priorities of the private sector. The largest publicly funded examination of genetically engineered agriculture—the UK government's field trials—found GM crops inferior to conventional agriculture in most respects. But conventional and GM agriculture are not the only two comparison points.

Advocates of sustainable agriculture have a healthy sense of counterfactuals. Most environmentalists I know are very keen to see public research money spent on promising agro-ecological technologies, which peer-reviewed studies have consistently found to be appropriate and promising answers to the problems of world hunger. The fear of this sort of research doesn't seem to be coming from environmentalists. It's coming from those whose profits would be harmed by sustainable agriculture.



A Little Common Sense, Please

a geneticist and molecular biologist who developed several modern techniques used to study and modify plants, is science and technology adviser to the US Secretary of State and to the administrator of USAID. She is also a professor at Pennsylvania State University and author of Mendel in the Kitchen: A Scientist's View of Genetically Modified Food.

The disconnect between what people worry about and what's true about GM crops is deep and wide—a chasm, really. Is it about the technology itself or is it about all kinds of other things?

With a computer and bit of effort, almost anyone can extract the facts from the gloom and catastrophism. Fact: Modern genetic modification of crops is responsible for most of the crop yield increases of recent years. This means, of course, that the farmers who've adopted GM crops have benefited the most. These already number more than 13 million, 90 percent of whom are resource-poor, small-holder farmers in relatively poor countries.

So far, so good, yes? But there's more. Insect-resistant Bt crops have reduced pesticide use a lot. Less pesticide means more beneficial insects and more birds. Herbicide-tolerant crops have made big strides in reducing topsoil loss by enabling no-till farming. Keeping the soil on the land and retaining the organic matter and water in the soil supports all the creatures that make for healthy dirt. There is simply no evidence—after 13 years and almost 2 billion acres grown—that GM food is bad for people or animals. Meanwhile, there is ample evidence that levels of contaminating fungal toxins—very bad for people and animals—are much lower in GM corn than in either the conventional or organic versions.

Why would any environmentalist or champion of sustainable farming oppose such progress? Why the anti-GM hysteria?

I think the reasons are embedded in our psyches, and not just those of

Europeans. (If they've had more problems than Americans with GM foods, the opposite has been true with food irradiation and stem cells). We kinda like scary stuff so that's what newspapers publish, and that's what we remember (not boring old statistics). This is how urban legends about the bad effects of GM crops and foods get started. There's the widely believed "terminator seeds" myth—an idea that earned a bad name but never got off paper. And then there was the GM corn-kills-Monarch-butterflies story. In reality, in the worst-case scenario, one in 2,500 larvae might be affected by Bt pollen, as compared with the 90 percent death rate of pesticide-sprayed insects. Once rooted, however, such urban myths are hard to dislodge with feeble facts.

From the perspective of the GM critics, the bad guys are "multinationals" and "big agribusiness." Almost everyone's convinced that Monsanto is bad, tantamount to a Monsatan. That European scientists contributed significantly to the development of GM techniques is lost in the hyper-concentrated focus on the US companies who brought them to farmers and are making money doing so. Such "technology transfer" was in the past regarded as a good thing, but has now become a favorite whipping boy of GM critics—especially if there's money to be made. And the anti GM-ers circulate some pretty odd stories: Monsanto's going to "force" farmers to buy its seeds. If farmers keep their seeds to plant next year, Monsanto is going to come and get them. (Um, how's it going to do that?) A little common sense, please.

Then there are the romantic agri-myths, like the "organic" one, which lots of people have bought into. It goes like this: Organic food, farmed using manure instead of chemicals, is better for you and better for the land. None of that's true—nitrogen is nitrogen—but it's pretty good marketing if you're selling poor produce at exorbitant prices. (Organic farming is inefficient, so production costs are generally higher.)

Finally, there's the myth that GM crops are untested. The truth is that they're the most thoroughly tested foods ever to have been incorporated into our food supply.



Scientific Consensus on GM is an Illusion

Tom Philpott is the food editor at Grist.org, where he maintains the column "Victual Reality." He also farms and cooks at Maverick Farms, a sustainable-agriculture nonprofit and small farm in the Blue Ridge Mountains of North Carolina.

The assumption is that a global scientific consensus has formed around the value of patent-protected transgenic crops, analogous to the general agreement around human-induced climate change. Yet that is clearly false.

Let's start by looking at the International Assessment of Agricultural Knowledge, Science, and Technology for Development (IAASTD), a three-year project to assess the role of agricultural knowledge, science, and technology in reducing hunger and poverty, improving rural livelihoods, and facilitating environmentally, socially, and economically sustainable development.

Widely compared to the Intergovernmental Panel on Climate Change (IPCC), which definitively established a scientific consensus around climate change on its release in 2007, the IAASTD engaged 400 scientists from around the globe under the aegis of the World Bank and the UN's Food and Agriculture Organization. According to the Executive Summary of the Synthesis Report, the effort was originally "stimulated by discussions at the World Bank with the private sector and nongovernmental organizations (NGOs) on the state of scientific understanding of biotechnology and more specifically transgenics."

If transgenic-crop technology had captured the broad approval of the global agricultural-science community, here was the place to show it. But what happened? According to the Executive Summary of the Synthesis Report:

Assessment of biotechnology is lagging behind development; information can be anecdotal and contradictory, and uncertainty on benefits and harms is unavoidable. There is a wide range of perspectives on the environmental, human health and economic risks and benefits of modern biotechnology; many of these risks are as yet unknown.

...

The application of modern biotechnology outside containment, such as the use of genetically modified (GM) crops, is much more contentious [than biotechnology within containment, e.g., industrial enzymes]. For example, data based on some years and some GM crops indicate highly variable 10 to 33 percent yield gains in some places and yield declines in others.

The report goes on to call for a whole new framework for crop-biotechnology research—an implicit rebuke to the current one:

Biotechnologies should be used to maintain local expertise and germplasm so that the capacity for further research resides within the local community. Such R&D would put much needed emphasis onto participatory breeding projects and agroecology.

Thus, whereas the IPCC revealed broad agreement among the global scientific community around climate change, the IAASTD—arguably the “IPCC of agriculture”—showed deep ambivalence among scientists over transgenic crops.

The real question becomes: How can serious publications like *Seed* claim that skepticism toward GMOs reflects a “scientific flip-flop”? To be sure, the illusion of a broad consensus holds sway in the United States, and the IAASTD has clearly failed to correct it. The US media greeted its release with near-complete silence—in stark contrast to its reception in the European media.

So, how did this spectral scientific consensus for GMOs come into being? In a two-part article called “[The Genetic Engineering of Food and The Failure of Science](#),” recently published as a “work in progress” by the peer-reviewed *International Journal of the Sociology of Food and Agriculture*, the agroecologist Don Lotter ventures to answer this.

Lotter’s paper traces the history of the rise of plant transgenics, convincingly arguing that political and economic power, not scientific rigor, have driven the technology’s ascent. He shows that the hyper-liberal US regulatory regime around GMOs stems not from an overwhelming weight of evidence, but rather from close, often revolving-door ties between the industry and US administrations dating back to Reagan. Take the assumption that transgenic foods have been proven to have no ill effects on human health. Far from being exhaustively studied, it turns out, that question has been largely ignored—left by US regulators to be sorted out by the industry itself. When there have been long-term trials by independent researchers, the results have hardly been comforting.

For example, writes Lotter:

In a 2008 report (Velimirov et al., 2008) of research commissioned by the Austrian government, a long-term animal feeding experiment showed significant reproductive problems in transgenic corn-fed rats when all groups were subject to multiple birth cycles, a regimen that has not hitherto been examined in feeding studies comparing transgenic and non-transgenic foods.

Thus in the *first-ever* multi-generational study of the effects of GMO food, evidence of serious reproductive trouble comes to light: reduced birth weight and fertility. If the reproductive system can be viewed as a proxy for broad health, then the Austrian study raises serious questions about the effects of consuming foods derived from transgenic crops—i.e., upwards of 70 percent of the products found on U.S. supermarket shelves. Yet, as in the case of the IAASTD, the Austrian study dropped with a thud by the US media.

The Austrian results raise an obvious question: why did the first multigenerational study of the health effects of GMOs emerge more than a decade *after* their broad introduction in the United States? Lotter devotes the [second half](#) of his paper, “Academic Capitalism and the Loss of Scientific Integrity,” to answering that question.

Lotter traces the generally blasé approach to GMO research to “the restructuring of research university science programs in the past 25 years from a non-proprietary ‘public goods’ approach to one based on dependence on private industry.” He teases out the following ramifications:

- tolerance by the scientific community of bias against and mistreatment of non-compliant scientists whose work results in negative findings for transgenics, including editorial decisions by peer-reviewed journals, as well as tolerance of biotechnology industry manipulation of the information environment
- monopolization of the make-up of expert scientific bodies on transgenics by pro-industry scientists with vested interests in transgenics
- deficient scientific protocols, bias, and possible fraud in industry-sponsored and industry-conducted safety testing of transgenic foods
- increasing politically and commercially driven manipulation of science within federal regulatory bodies such as the FDA

Lotter delivers well-documented examples to support each of those charges. He shows, for example, that the USDA dispersed \$1.8 billion for crop biotechnology research to universities between 1992 and 2002, of which one percent (\$18 million) went to “risk-related research.” He cites another peer-reviewed study showing that university biotech research has “overwhelmingly been targeted at plants and traits that are of interest to the largest firms,” and that “research on non-proprietary solutions which benefit the wider public has been lacking...This arena should be central to the mission of universities and other non-profit research institutions.”

It’s worth noting that the IAASTD points out similar concerns in the industry-dominated research agendas at public universities:

An emphasis on modern biotechnology without ensuring adequate support for other agricultural research can alter education and training programs and reduce the number of professionals in other core agricultural sciences. This situation can be self-reinforcing since today’s students define tomorrow’s educational and training opportunities.

A recent event [reported](#) by the *New York Times* illustrates the lack of independence—and thus, arguably, rigor—that surrounds too much GMO research. A group of 23 US scientists signed a letter to the EPA declaring that, “No truly independent research [on GMOs] can be legally conducted on many critical questions.” The *Times* reported that because of draconian intellectual property laws, scientists can’t grow GMO crops for research purposes without gaining permission from the corporations that own the germplasm—permission which is sometimes denied or granted only on condition that the companies can review findings before publication.

Stunningly, “The researchers ... withheld their names [from the EPA letter] because they feared being cut off from research by the companies,” *The Times* reports.

So this is the sort of scientific consensus around GMOs that environmentalist should bow to—one literally based on fear among tenured faculty?

Ultimately, scientific responses to the advent of climate change and the rise of GMOs make a poor comparison. The consensus around climate change developed *in spite of* a multi-decade campaign by some of the globe’s most powerful and lucrative industries—the petroleum and coal giants—to protect markets worth hundreds of billions of dollars. The consensus around GMOs—or at least the specter of one—arose through the lobbying and support of an industry desperate to protect its own multibillion-dollar investments. I predict this bought-and-paid-for consensus will prove short-lived.



The Case of “Nuclear Rice”

Noel Kingsbury is a horticulturalist and writer. His latest book, Hybrid: The History and Science of Plant Breeding, will be published in October by Chicago University Press.

People are simply not objective or “rational” when it comes to what science they believe, as illustrated by the different attitudes to GM in the US and in Europe. It has been the misfortune of GM technology to have arrived at a time when there is such distrust of science *and* the wholesale privatization of the crop-breeding industry (it used to be largely state-owned in the US, the UK, and many other European countries).

Most of those who oppose GM crops have failed to separate the two sides of the issue: the control of the technology by corporations and the safety/environmental aspects. During the 1980s mega-corporations like Monsanto, with no history of plant breeding, took over the business and promoting of GM crops. But the technology does not have to be controlled by the likes of Monsanto. One of the biggest investors in GM is the Chinese government, and the Dr. Swaminathan Institute in India is an example of a not-for-profit investing in developing “GM crops for poor people.”

The fact is that the scientific case against GM is pretty threadbare. It is far more precise and predictable than some of the most important breeding technologies of the last 50 years. If you get hot under the collar about GM, why not the far more frightening “radiation breeding”? Mention that to most anti-GM activists and they look puzzled. Radiation breeding involves zapping seeds or cuttings with radiation, or treating plant material with gene-altering chemicals. Many countries in the 1960s invested in “radiation fields” where trees were grown behind big earthen dykes so that they would be permanently irradiated. The goal: obtaining mutations that might be useful, as one in several tens of thousands was. The first radiation-bred rice was sold as “Nuclear Rice” in Hungary in the mid-1950s. Imagine marketing that today! Radiation breeding is unpredictable, uncertain in its results, and causes widespread genome damage. *But no one has ever suggested that it has ever done any harm!* Much Italian pasta has been grown with an irradiated durum wheat. Nearly all Asian pears are the offspring of irradiated grafts. And—get this— much European organic beer is brewed from radiation-bred barley! No one complains or protests. Wake up! Be realistic! Why get so excited by GM?

GM crops must be looked at and judged variety by variety. The first generation Roundup™ varieties are giving way to second generation crops with some highly valuable characteristics, like resistance to pests (thousands of deaths by pesticide poisoning have already been avoided by Chinese and Indian caterpillar-proof cotton) and drought-tolerance. Once we start to see soy with omega-3s or nutrient-enhanced tomatoes, attitudes will surely start to change.

World population is increasing, arable land availability is decreasing, and water resources are shrinking. We need every technology possible to increase yields, reduce toxic pesticide use, improve nutritional value, and feed the world. The European and Indian opposition to GM is rooted in a hopelessly romantic view of farming. Farming is not a romantic business—it is about feeding the human race, and we must listen to the overwhelming consensus of plant science—that GM is safe and desirable.

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