Imitation of Life

The food that you eat may seem the same as it was ten years ago. It's not—and the opportunity to control the complete reinvention of agriculture is rapidly vanishing BY DAVID SHENK

IN 1997, someone phoned the toll-free snitch line of bio-ag giant Monsanto to suggest that a Canadian family farmer named Percy Schmeiser was illicitly growing Monsanto's genetically modified canola on his land in Saskatchewan. The company instructed an investigator to seize plant samples from Schmeiser's crop for DNA testing. When these and other tests came back positive, Monsanto sued Schmeiser for using its patented material without paying the required annual licensing fee.

Schmeiser fought back, arguing that Monsanto—the world's largest developer of genetically modified crops—was the villain in this story, that their unwanted seeds had blown onto his land from one of his five neighbors growing the GM canola. Monsanto's canola, Schmeiser said, had contaminated his home-cultivated, non-GM crops against his will.

One of the peculiar lessons of history is that cataclysmic events are not always as deafening as a hydrogen bomb; they can be as quiet and invisible as pollen floating blithely through the air. Farmers have known for a long time that pollen and seeds can spread for great distances in the wind and through farm equipment. But what happens when the DNA inside those seeds is handcrafted, carefully guarded private property?

Reaping what we sow: Genetically modified soybeans are ubiquitous on supermarket shelves, in our kitchens, and in the average lunchbox.

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Who is responsible for unintended proliferation? Who carries the burden of proof? Who the liability? How can anyone control the spread or even pretend to know the true implications of an invention that a) is a living thing; b) is beyond complete human understanding; and c) has no moral, legal, or political precedent?

So begins a long list of difficult new questions for a world where farming is fast becoming another realm of intellectual property, where crops are not so much bred as programmed via adjustable code. In the years after Monsanto first filed suit, *Monsanto* v. *Schmeiser* attracted the attention of lawyers, judges, regulators, scientists, and seed companies from around the world, all of whom recognized that the case would be among the first thorough vettings of these novel issues. The stakes were so high for Monsanto that the company was willing to risk the inevitably unflattering Goliath-crushes-David publicity in order to establish a crucial legal precedent.

It was a complex case, and neither side turned out to be the angelic victim it had claimed to be. But Monsanto did get what it wanted. Last May, the Canadian Supreme Court upheld Monsanto's patent and did not contradict a lower court's ruling that Monsanto's genetic ownership had no inherent geographic limits. It didn't matter how or where it spread: Monsanto's patented seed was Monsanto's seed. The company was thrilled. "The Supreme Court has set a world standard in intellectual property protection," it stated.

Courts in other nations may or may not precisely follow this new "world standard." But as a symbol, the Canadian decision does indeed epitomize the extraordinary change taking place in agriculture all over the world: a power shift away from small, indigenous farmers toward multinational companies that genetically modify crops, secure broad legal rights to their inventions, and then enforce those patents with efficiency and aggression. In just a single decade, agricultural transgenics has been transformed from a fledgling science into a dominant force in the world's food supply, from almost zero acreage in the early 1990s to more than 160 million crop acres worldwide in 2003, and near total domination of some foods. Already, as much as 80 percent of the U.S. soybean crop is genetically modified, and as much as 40 percent of U.S. corn. A quarter of the world's canola, cotton, corn, and soybean crop is now transgenic. The Washington, D.C.–based Center for Food Safety estimates that up to 60 percent of processed foods sold in supermarkets—including soda, soup, and crackers—contains some GM ingredients. Indeed, they're virtually impossible to avoid. One sign of GM's ubiquity in staples like textured vegetable protein, lecithin, and vitamin E is that the Whole Foods supermarket chain, which is built on its organic image, cannot guarantee that its stores are GM free.

Students testing a transgenic soil bacterium found that its creators had accidentally created a fungus killer that "could have ended all plant life on this continent."

And, of course, the genetic engineers are just getting started. Technology that allows scientists to cut and paste any gene from any plant or animal into any other plant or animal opens up a sky of possibilities. Already in testing are tomatoes with synthetic flounder "antifreeze" genes, rice with vitamin-producing daffodil genes, and "Enviropigs" with mouse and bacteria genes that enable them to produce manure that is more environmentally friendly. These experiments put us on the threshold of a very different world—one that, to be sure, will be full of scientific marvels and much progress. But they also suggest critical health, environmental, and economic questions that we seem to be racing not to answer.

Take GM fish, for example. In 2000, scientists at Purdue University observed that the small freshwater fish called medaka, when enhanced with the salmon growth hormone gene, grew faster and had a mating advantage but also a much higher mortality, prompting an estimate that a mere 60 of these GM fish escaping into a wild population of 60,000 would produce local extinction within 40 generations. This was just a lab experiment, and medaka is not a fish that is raised for food. But the implications are unmistakable. "It's important to understand the risks," said Purdue breeding and genetics professor Bill Muir.

An especially frightening episode was reported recently by environmental author John Robbins. Students at Oregon State University, testing a transgenic variant of the soil bacterium *Klebsiella planticola*, found that its creators had accidentally invented a fungus killer that, had it gotten out into the wild, "could have ended all plant life on this continent," said renowned Canadian geneticist David Suzuki. "The implications of this single case are nothing short of terrifying."

The question, of course, is whether we will understand enough of the risks before it's too late to do anything about them. An open letter signed by Suzuki and 736 other scientists—including Harvard's Ruth Hubbard, MIT's Jonathan King, and Woods Hole director George Woodwell—called on governments to take a much more cautious approach. "The hazards of [genetically modified organisms] to biodiversity and human and animal health are now acknowledged by sources within the U.K. and U.S. governments," it said. "Particularly serious consequences are associated with the potential for horizontal gene transfer. These include the spread of antibiotic resistance marker genes that would render infectious diseases untreatable, the generation of new viruses and bacteria that cause diseases, and harmful mutations which may lead to cancer."

Sensible reservations notwithstanding, the restructuring of nature is now a growing facet of our new economy and a permanent, if still invisible, ingredient in our kitchen lives. Monsanto's GM canola plant, for instance, contains genetic code from a pea plant, a figwort mosaic virus, a wall cress plant (*Arabidopsis thaliana*), the common soil bacterium *Agrobacterium tumefaciens*, and the common bacterium *Ochrobactrum anthropi*.

HOW SAFE IS ALL THIS? We really have no idea. Conveniently, the transgenic crop industry has found a way to make science that is literally life altering seem same old, same old. In its public report, Monsanto promises an "equivalent nutritional composition and wholesomeness of [its GM] canola compared to conventional canola varieties," and that "the potential impact ... on the environment is no different than conventional canola varieties."

Let's hope they're correct. We'll have to take Monsanto's word for it, since transgenic foods are subject to very little

health and safety scrutiny in the U.S. The official policy of the FDA is essentially to ask for, and be contented with, industry assurances that each particular GM food is "substantially equivalent" to an existing food. After being certified as such by their corporate sponsors, transgenic foods are subject to none of the analysis that applies to more conventional food additives. (Thus far, every GM food on the market has, not surprisingly, been designated as "substantially equivalent" to something.) There are also no requirements at all for long-term environmental testing of such products. For assurances that transgenic foods are not jeopardizing our ecosystem, the public is again left to rely solely on the industry that creates and profits from them. "That verbiage—'substantially equivalent'—was a brilliant construction by the people who wanted regulations out of the way," explains the Center for Food Safety's Craig Culp. "But how can you not acknowledge that there's a substantial difference between an ordinary tomato and a tomato with a flounder gene in it? There is a willful ignorance about this in the regulatory agencies."

The European Union and Japan have famously taken the opposite regulatory tack, subjecting genetic modification to very strict scrutiny and severely restricting most of it. The stark difference in approach comes down not so much to science as to one's risk philosophy, says Lawrence Busch, director of Michigan State University's Institute for Food and Agricultural Standards. "The U.S. has said, 'We're going to get this stuff to the market as fast as we can. We know we'll make some mistakes along the way. When we have mistakes, we know we'll have some costly recalls.' The E.U. has taken the opposite approach, taking it slower, minimizing the risks and the gain."

LOOPING AROUND THE DISTRICT OF COLUMBIA, it's only about a 35-minute drive from the FDA, on Fishers Lane in Rockville, Maryland, to the U.S. Patent and Trademark Office, on Dulany Street in Alexandria, Virginia. Intellectually, though, you've just traveled to another planet. Here at the Patent Office, lawyers for companies like Monsanto argue that their genetic inventions are not ho-hum "equivalent" to existing products but are actually shockingly unique—so much so, in fact, that they deserve special legal protection for 20 years.

In 1980, the U.S. Supreme Court revolutionized the relationship between law and biology by ruling that new transgenic life-forms could be patented—life could be invented and owned. Since then, the U.S. Patent Office has seemed eager to grant spectacular intellectual property protection to genetic "inventions." In 1988, two Harvard geneticists were awarded a patent that stemmed from their experiments with the "OncoMouse," which contained a cancer-causing gene from another species. In 1992, the biotech company Agracetus obtained a patent on all genetically engineered cotton—not just the specific life-form they created but also any future transgenic cotton. In 1994, the same company was awarded a similar patent in Europe, covering all genetically engineered soybeans.

In 1997, Texas-based RiceTec, Inc., obtained a patent for genetically engineered rice derived substantially from the prized basmati rice of the Himalayan foothills in northern India and Pakistan. (Upscale American grocery shoppers are familiar with RiceTec's popular RiceSelect rice brands Texmati, Kasmati, and Jasmati.) RiceTec's broad patent potentially gave it control over all U.S. basmati commerce, raising the prospect that the company could limit the imports from—and/or squeeze royalties out of—the very farmers who had developed the rice over thousands of years. Understandably, it infuriated Indian and Pakistani farmers and their governments. One Indian agricultural official suggested that the World Trade Organization penalize the U.S. for encouraging such raids on indigenous property. "The basmati patent exposes the mounting threat posed by multinationals to crops developed and grown by poor farmers for generations," observed London-based food-trade policy analyst Ruchi Tripathi.

PATENTS ARE NOT SACRED; they can be disputed and invalidated. In 1994, Agracetus's cotton patent was revoked. And in 2000, the Indian government launched a legal challenge to RiceTec's patent, and most of it was eventually struck down. But that took time and resources. The current apparatus places the legal and financial burden on the challengers, which GM critics argue is like expecting hens to wait for the murderous raid and then sue the fox. "Thousands of years of plant breeding by countless generations of farmers have been hijacked in a very short period of time by the biotech industry," says activist Luke Anderson, author of *Genetic Engineering, Food, and Our Environment*. "With these patents they can demand exclusive monopoly rights to these genetically engineered crops. We are now witnessing the legally sanctioned corporate theft of the biological commons."

Corporate patents can also be *preempted* by farmers' cooperatives securing rights to their own resources—as Quechua Indians in Peru have just done with 246 varieties of potatoes they've been cultivating for more than 7,000 years. This and other strategies are going to be critical if indigenous farmers are going to defend themselves against what Anderson and other activists describe as an ominous pattern in recent years of First World lawyers aggressively moving in on Third World resources. These include: RiceTec's basmati patent; an effort by a number of pharmaceutical companies to patent products from the neem tree, which is known in India as the "village pharmacy" for its antiseptic, antiviral, anti-inflammatory, antiulcer, and antifungal properties; and a patent obtained in 1999 by the Colorado-based entrepreneur Larry Proctor on a yellow bean developed (through selective breeding, not transgenics) from the Mexican Mayacoba bean. Proctor claimed his bean was a novel color, and attempted to restrict the import, sale, and production of all beans of the same hue. It was "a textbook case of bio-piracy," declared ETC Group, a technological and agricultural watchdog. "Yellow beans have been grown in Mexico for centuries, developed by farmers and more recently by plant breeders." Proctor responded: "[They] called us a bio-pirate, but we did exactly what plant breeders have done for centuries in improving plant types and bean types across the country. We let bean types be crossed and then we segregated them off and monitored them until we had something that was stable, to our liking, and different from what was known before." The patent is currently being challenged by the Colombia-based International Center for Tropical Agriculture.

Some of the accused corporations themselves have also been known to complain about overly broad patents. In fact, some of the bluntest early criticism of Agracetus's soybean patent came from one of its competitors, Monsanto. "The alleged invention lacks an inventive step," Monsanto asserted in a formal protest to the soybean patent. It was "not ... novel." In 1996, though, Monsanto apparently realized there (Continued on page 147)

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FOOD

THE MAN WHO CAME TO DINNER **Page 110: Goose** or **duck fat**—some specialty foods shops and D'Artagnan (800-327-8246). **Japanese Benriner**—Asian markets, some cookware shops, and Uwajimaya (800-889-1928). FRESH **Page 122: Semolina**—Italian markets, specialty foods shops, and farawayfoods.com. **Dried California apricots**—many specialty foods shops, natural foods stores, and Much Ado of California (driedfruitandnuts.com). IN BLOOM **Pages 130–131: Slab bacon**—some specialty foods shops and butcher shops. **Dandelion greens**—farmers markets and specialty produce markets. **Pearl (Israeli) couscous**—Middle Eastern markets, specialty foods shops, and Kalustyan's (212-685-3451). **Wild salmon**—some specialty foods shops and Wild Edibles (212-687-4255; wildedibles.com). **Blackberry syrup**—coffeeam.com (800-803-7774) and Kalustyan's.

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was a more profitable solution. It bought Agracetus for $150 million, making the patent it once claimed was "not novel," its own. (Asked now about the legitimacy of that soybean patent, Monsanto declines to comment.)

The costs of cutting-edge genomics combined with global outreach to farmers, regulators, and courts apparently make agrogenetics a game for only the biggest corporate fish. Massive consolidation of the industry in recent years has left just a handful of corporations virtually dictating the terms of commercial farming. According to ETC Group, in 2002 the top ten seed companies took in nearly one third of all commercial seed revenues. Four of them (Monsanto, Dupont, Syngenta, and Dow), Monsanto reports, controlled more than three quarters of the world's commercial corn market and about half of the world's soybean market (excluding China).

These supersize biotechs promise that they're going to not only make a lot of money for their shareholders but also make the world a much better place. "The most compelling case for biotechnology, and more specifically GM crops," says the International Service for the Acquisition of Agri-biotech Applications, "is their capability to contribute to: increasing crop productivity ... conserving biodiversity ... a more sustainable agriculture and environment ... and to the improvement of economic and social benefits and the alleviation of abject poverty in developing countries."

THE NEEDS ARE REAL, to be sure. The UN Food and Agriculture Organization reports that hunger and malnutrition are on the increase. But will a brave new world of patented transgenic foods make a substantial difference? It's difficult to see how, and the expert consensus is that feeding the world depends considerably more on political than scientific progress. That's because the roots of world hunger have much more to do with food distribution, poverty, war, and economic disenfranchisement than they do with crop yields. "Seeking a technological food fix for world hunger may be ... the most commercially malevolent wild-goose chase of the new century," Dr. Richard Horton, editor of British medical journal *The Lancet*, has said. His sentiments were echoed by Stephen Smith, head of Syngenta Seeds in the U.K. until his death in 2003. "If anyone tells you that GM is going to feed the world," Smith said, "tell them that it is not .... To feed the world takes political and financial will—it's not about production and distribution." Representatives of developing countries in Africa have been so offended by what they consider industry propaganda on the subject that, in 1998, a delegation representing every African nation except South Africa released a statement that read, in part:

We ... strongly object that the image of the poor and hungry from our countries is being used by giant multinational corporations to push a technology that is neither safe, environmentally friendly, nor economically beneficial to us .... We do not believe that such companies or gene technologies will help our farmers to produce the food that is needed in the 21st century. On the contrary, we think it will destroy the diversity, the local knowledge, and the sustainable agricultural systems that our farmers have developed for millennia, and that it will undermine our capacity to feed ourselves.

Supporters of agricultural transgenics point to the lower costs and direct economic benefits already being enjoyed by millions of farmers. GM antipest plants are indeed environmentally friendly, they say, allowing farmers to use far fewer pesticides, and near-future transgenic crops will withstand more-severe weather—an obvious boon. Detractors, though, insist that the risks are simply too great for transgenics to move ahead without further scrutiny. The combined force of life-altering technology, powerful legal armor, and corporate consolidation is putting agriculture and all of us who depend on it onto a course that is unpredictable and precarious. "We have a history in this country of cheerleading science just because it is science, without having a real understanding of what that science is doing for us or to us," says the Center for Food Safety's Craig Culp. "With transgenic organisms, we are at a critical juncture. At some point we will have lost control of them. We have an opportunity now, a window to say, 'Wait a minute, certain applications of this may be fine, but we have some fundamental questions to answer first.'"

Culp's window will not be open for long.