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Monsanto: Origins of an Agribusiness Behemoth

– Brian Tokar

Many years ago, in the spring of 1998, I was invited to be part of a publication that would make history, but not for the reasons its editors and publisher anticipated. The item in question was a special issue of the UK-based magazine, *The Ecologist*, profiling the Monsanto corporation and its expanding push to genetically engineer common food crops. Genetically engineered foods, or GMOs (*i.e.*, foods made from Genetically Modified Organisms) had only been grown commercially for two short years, but had already inspired massive worldwide opposition. The first Global Day of Action against GMOs featured demonstrations and public gatherings in 19 U.S. cities, as well as 17 European countries, India, the Philippines, Malaysia, Japan, Canada, Australia, New Zealand, Brazil and Ethiopia.[1] Greenpeace painted a 100-foot biodegradable "X" on a field of Roundup-resistant soybeans in Iowa, and later blocked a ship containing genetically engineered soybeans from leaving Cargill's grain facility on the Mississippi River, outside of New Orleans.[2] European activists fought to block imports of GMO corn and soybeans from the U.S., uprooted experimental plots of engineered crop varieties in broad daylight, and would soon succeed in their push for labeling requirements for products of genetic engineering throughout the European Union.

Monsanto, which was already the most aggressive promoter of GMO agriculture on both sides of the Atlantic, fought back with as much hype and political clout as they could muster. They had already derailed Congressional efforts to regulate GMOs in the U.S., forcing public officials to rely on food and plant safety laws that long predated the new technology. The company tried to brand itself literally as a savior of humanity, uniquely able to feed the world's nutritionally insecure masses. A pervasive advertising campaign across the U.K. aimed to convince readers that the future of global agriculture depended on Monsanto's ability to enhance future harvests.

In those days *The Ecologist* was probably the leading popular journal of environmental research and activism in the English speaking world. Its readers were active on every continent, and its reputation was unsurpassed, even after a team of internationally acclaimed editors departed following a dispute with the magazine's publisher. With a foreword by Prince Charles and articles by some of the leading U.S. and U.K. critics of the global biotechnology and pesticide industries, this special edition was bound to have a major impact.

Apparently, someone on the other side felt the same way. Just as subscribers were anticipating receipt of their September/October 1998 issue of *The Ecologist*, word got out that the printer, Penwells of

Saltash Cornwall, had physically destroyed all 14,000 copies.[3] The printer refused to comment on the incident and Monsanto denied any involvement, but commentators widely agreed that fear of a libel suit was the most likely motive. The "Monsanto Files" special issue did not appear for several more months, but it was eventually reprinted several times and *The Ecologist* later reported that they had distributed over 100,000 copies.

Today's Monsanto company is a far more specialized operation than it was in the 1990s. Indeed, by the time you read this, it may no longer even exist, as Monsanto has been seeking regulatory approval since 2016 to merge with the German pharmaceutical and agrochemical giant Bayer, the world's largest manufacturer of insecticides. While the Monsanto of the early 2000s to 2010s focused almost entirely on biotechnology, seeds, and a limited range of agrochemicals, especially its Roundup brand herbicides, it was once a broadly diversified chemical manufacturer, one of only four to be listed among the top ten U.S. chemical companies in every decade from the 1940s - 1990s.[4] In 1997, Monsanto spun off various industrial chemical divisions into a new company called Solutia, seeking to limit its liability from a vast array of lawsuits. These included a successful suit by Vietnam veterans contaminated by the company's notorious Agent Orange herbicide mixture, which the U.S. Army used to destroy the rainforests of Vietnam, and others brought by communities in the U.S. South where Monsanto manufactured PCBs (polychlorinated biphenyls) for numerous industrial uses. A merger and subsequent divestment just a few years later led to the acquisition of Monsanto's profitable pharmaceutical division, G.D. Searle, by the transnational drug company, Pharmacia. Monsanto lost half its share value during those complex transactions, and saw its fortunes ebb and flow quite dramatically as its focus narrowed to the highly volatile agribusiness sector. To better understand the company's emergence as the leading developer and promoter of genetically manipulated agriculture and Roundup herbicides, it is important to first examine its history.

Origins

The Monsanto Chemical Company was founded in St. Louis in 1901 by John Francis Queeny. A self-educated chemist, Queeny brought technology to manufacture saccharin, the first artificial sweetener, from Germany to the United States. In the 1920s, Monsanto became a leading manufacturer of sulfuric acid and other basic industrial chemicals, and by the 1940s, plastics and synthetic fabrics were the centerpiece of its business. In 1947, a French freighter carrying ammonium nitrate fertilizer blew up at a dock 270 feet from Monsanto's plastics plant outside Galveston, Texas. More than 500 people died in one of the U.S. chemical industry's first major disasters.[5] The plant was manufacturing styrene and polystyrene plastics, which are still important constituents of food packaging and other products; in the

1980s the U.S. Environmental Protection Agency (EPA) listed polystyrene as fifth in its ranking of the chemicals whose production generates the most total hazardous waste.[6]

In 1929, the Swann Chemical Company, soon to be purchased by Monsanto, developed polychlorinated biphenyls (PCBs), which were widely praised for their nonflammability and chemical stability. The most widespread uses were in the electrical equipment industry, which adopted PCBs as a nonflammable coolant for a new generation of transformers. By the 1960s, Monsanto's growing family of PCBs were also widely used as lubricants, hydraulic fluids, cutting oils, waterproof coatings and liquid sealants. Evidence of the toxic effects of PCBs appeared as early as the 1930s, and Swedish scientists studying the biological effects of DDT also began finding significant concentrations of PCBs in the blood, hair and fatty tissue of wildlife in the 1960s.[7]

Research in the 1960s and seventies revealed PCBs and other aromatic organochlorines to be potent carcinogens, and also traced them to a wide array of reproductive, developmental and immune system disorders.[8] Their high chemical affinity for organic matter, particularly fat tissue, was responsible for their dramatic rates of bioaccumulation, and their wide dispersal throughout the North's aquatic food web: Arctic cod, for example, once carried PCB concentrations 48 million times that of their surrounding waters, and predatory mammals such as polar bears harbored tissue concentrations of PCBs more than fifty times greater than that. Though the manufacture of PCBs was banned in the United States in 1976, its toxic and endocrine disruptive effects persist worldwide.[9]

The world's center of PCB manufacturing was Monsanto's plant on the outskirts of East St. Louis, Illinois. East St. Louis is a chronically economically depressed suburb, across the Mississippi River from St. Louis, bordered by two large metal processing plants in addition to the Monsanto facility. "East St. Louis," reported education writer Jonathan Kozol, "has some of the sickest children in America." Kozol reported that the city had the highest rate of fetal death and immature births in the state, the third highest rate of infant death, and one of the highest childhood asthma rates in the United States.[10]

Dioxin: A Legacy of Contamination

The people of East St. Louis continued to face the horrors of high level chemical exposure, poverty, a deteriorating urban infrastructure, and the collapse of even the most basic city services, but the nearby town of Times Beach, Missouri was found to be so thoroughly contaminated with dioxin – a byproduct of Monsanto's herbicide manufacture – that the U.S. government ordered the whole town evacuated. Hundreds of horses, pets and wild birds had died, and children born to mothers exposed to the dioxin-contaminated oil demonstrated evidence of immune system abnormalities and significant brain

dysfunction.[11] While Monsanto consistently denied any connection to the incident, the St. Louis-based Times Beach Action Group (TBAG) uncovered laboratory reports documenting the presence of high concentrations of PCBs manufactured by Monsanto in dioxin-contaminated soil samples from the town.[12] "From our point of view, Monsanto is at the heart of the problem here in Missouri," explained TBAG's Steve Taylor in a 1998 interview.

The contamination and attempted cover-up at Times Beach reached the highest levels of the Reagan Administration in Washington, and was a factor in the resignation of Reagan's EPA administrator, Anne Gorsuch Burford, mother of current Supreme Court Justice Neil Gorsuch. In one widely reported incident, the Reagan White House ordered Burford to withhold documents on Times Beach and other contaminated sites in Missouri and Arkansas and her special assistant, Rita Lavelle, was cited for shredding important documents; eventually Lavelle was jailed for perjury and obstruction of justice, and Burford was forced to resign.[13] An investigative reporter for the *Philadelphia Inquirer* identified Monsanto as one of the chemical companies whose executives frequently hosted luncheon and dinner meetings with Lavelle.[14] The evacuation sought by residents of Times Beach was delayed until 1982, eleven years after the contamination was first discovered, and eight years after the primary cause was identified as dioxin.

Monsanto's association with dioxin can be traced back to its manufacture of the potent herbicide 2,4,5-T, beginning in the late 1940s. "Almost immediately, its workers started getting sick with skin rashes, inexplicable pains in the limbs, joints and other parts of the body, weakness, irritability, nervousness and loss of libido," explains Peter Sills, author of *Toxic War* and a leading expert on dioxin and Agent Orange. "Internal memos show that the company knew these men were actually as sick as they claimed, but it kept all that evidence hidden."[15] An explosion at Monsanto's Nitro, West Virginia herbicide plant in 1949 drew further attention to these complaints. The contaminant responsible for these conditions was not identified as dioxin until 1957, but the U.S. Army Chemical Corps was already interested in this substance as a possible chemical warfare agent. A request filed by the *St. Louis Journalism Review* under the U.S. Freedom of Information Act revealed nearly 600 pages of reports and correspondence between Monsanto and the Army Chemical Corps on the subject of dioxin, going as far back as 1952.[16]

The herbicide mixture known as "Agent Orange," which was used by U.S. military forces to defoliate the rainforest ecosystems of Vietnam during the 1960s, contained 2,4,5-T and 2,4-D herbicides from several sources, but Monsanto's formulation had concentrations of dioxin many times higher than that produced by Dow Chemical, the defoliant's other leading manufacturer.[17] This made Monsanto the key defendant in the lawsuit brought by Vietnam War veterans in the United States, who faced an array of

debilitating symptoms attributable to Agent Orange exposure. When a $180 million settlement was reached in 1984 between seven chemical companies and the lawyers for the veterans, the judge ordered Monsanto to pay 45.5 percent of the total.

In the 1980s, Monsanto undertook a series of studies designed to minimize its liability in the Agent Orange suit, and also in continuing instances of employee contamination at its West Virginia manufacturing plant. A three and a half year court case brought by railroad workers exposed to dioxin following a train derailment revealed a pattern of manipulated data and misleading experimental design. An official of the U.S. EPA concluded that the studies were manipulated to support Monsanto's claim that dioxin's effects were limited to the skin disease chloracne.[18]

The court case, in which the jury granted a $16 million punitive damage award against Monsanto, revealed that many of Monsanto's products, from household herbicides to the Santophen germicide once used in Lysol brand disinfectant, were knowingly contaminated with dioxin. "The evidence of Monsanto executives at the trial portrayed a corporate culture where sales and profits were given a higher priority than the safety of products and its workers," reported the Toronto *Globe and Mail* after the close of the trial.[19] "They just didn't care about the health and safety of their workers," explains Peter Sills. "Instead of trying to make things safer, they relied on intimidation and threatened layoffs to keep their employees working."

A subsequent review by Dr. Cate Jenkins of the EPA's Regulatory Development Branch documented an even more systematic record of fraudulent science. "Monsanto has in fact submitted false information to EPA which directly resulted in weakened regulations under RCRA [Resources Conservation and Recovery Act] and FIFRA [Federal Insecticide, Fungicide and Rodenticide Act] . . ." reported Dr. Jenkins in a 1990 memorandum urging the agency to launch a criminal investigation of the company. Jenkins cited internal Monsanto documents revealing that the company "doctored" samples of herbicides that were submitted to the U.S. Department of Agriculture, manipulated technical arguments to deflect attempts to regulate 2,4-D and various chlorophenols, hid evidence regarding the contamination of Lysol, and excluded several hundred of its sickest former employees from its comparative health studies:

> Monsanto covered-up the dioxin contamination of a wide range of its products. Monsanto either failed to report contamination, substituted false information purporting to show no contamination or submitted samples to the government for analysis which had been specially prepared so that dioxin contamination did not exist.[20]

New Generation Herbicides

The use of chemical pesticides increased manifold during the post-World War II era. For example, total revenues from insecticide production rose from $10 million in 1940 to $100 million in 1950 to over $1 billion in the early 2000s. With this expansion, agrochemical companies in the U.S. and Europe established a profound degree of control over agricultural practices. The agrochemical industry set the agenda for changing farm practices, came to dominate agricultural policymaking and the information available to farmers, and also forged strategic alliances with the emerging global grain trading companies, such as Cargill, ConAgra and Archer Daniels Midland. Insecticide and herbicide use continued to grow, even as DDT and many other widely used chemicals were banned in the 1970s due to their extreme toxicity.

By the late 1990s, a new generation of glyphosate-based weed killers such as Roundup accounted for at least one sixth of Monsanto's annual sales and half of the company's operating income.[21] The importance of herbicide sales increased further after the company spun off its industrial chemicals and synthetic fabrics divisions in 1997. Monsanto has promoted Roundup as a safe, general purpose herbicide for use on everything from lawns and orchards, to large coniferous forest holdings, where aerial spraying of the herbicide has been used to suppress the growth of deciduous seedlings and shrubs and encourage the growth of profitable fir and spruce trees.[22] The Oregon-based Northwest Coalition for Alternatives to Pesticides (NCAP) reviewed over forty scientific studies on the effects of glyphosate, and of the polyoxyethylene amines (POEA) used as a surfactant in Roundup, and concluded in 1991 that the herbicide was far less benign than Monsanto's advertising suggests:

> Symptoms of acute poisoning in humans following ingestion of Roundup include gastrointestinal pain, vomiting, swelling of the lungs, pneumonia, clouding of consciousness, and destruction of red blood cells. Eye and skin irritation has been reported by workers mixing, loading and applying glyphosate. EPA's Pesticide Incident Monitoring System had 109 reports of health effects associated with exposure to glyphosate between 1966 and October, 1980. These included eye or skin irritation, nausea, dizziness, headaches, diarrhea, blurred vision, fever and weakness.[23]

It is important to note that Roundup was far less widely used in 1966-1980 than it is today.

A series of suicides and attempted suicides in Japan during the 1980s using Roundup herbicide allowed scientists to calculate a lethal dose of six ounces. The herbicide is 100 times more toxic to fish than to people, toxic to earthworms, soil bacteria and beneficial fungi, and scientists have measured a

number of direct physiological effects of Roundup in fish and other wildlife, in addition to secondary effects attributable to defoliation of forests.[24] Breakdown of glyphosate into N-nitrosoglyphosate and other related compounds heightened concerns about the possible carcinogenicity of Roundup products, long before glyphosate was declared a likely carcinogen by the World Health Organization in 2015.

A 1993 study at the University of California at Berkeley's School of Public Health found that glyphosate was the most common cause of pesticide-related illness among landscape maintenance workers in California, and the third leading cause among agricultural workers.[25] A 1996 review of the scientific literature by members of the Vermont Citizens' Forest Roundtable – a group that successfully lobbied the Vermont Legislature for a statewide ban on the use of herbicides in forestry – revealed evidence of lung damage, heart palpitations, nausea, reproductive problems, chromosome aberrations and numerous other effects of exposure to Roundup herbicides.[26] In 1997, Monsanto responded to five years of complaints by the New York State Attorney General that its advertisements for Roundup were misleading; the company altered its ads to delete claims that the herbicide is "biodegradable" and "environmentally friendly," and paid $50,000 toward the state's legal expenses.[27]

In March of 1998, Monsanto agreed to pay a fine of $225,000 for mislabeling containers of Roundup on 75 separate occasions. The penalty was the largest settlement ever paid for violation of the Worker Protection Standards of the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA).[28] This was only one of several major fines and rulings against Monsanto during the 1980s-90s, including a $108 million liability finding in the case of the leukemia death of a Texas employee in 1986, a $648,000 settlement for allegedly failing to report required health data to the EPA in 1990, a $1 million fine by the state Attorney General of Massachusetts in 1991 in the case of a 200,000 gallon acid wastewater spill, a $39 million settlement in Houston, Texas in 1992 involving the deposition of hazardous chemicals into unlined pits, and numerous others.[29] In 1995, Monsanto ranked fifth among U.S. corporations in EPA's Toxic Release Inventory, having discharged 37 million pounds of toxic chemicals into the air, land, water and underground.[30]

In the early 2000s, Roundup came to play a central role in the U.S. "drug war" due to its widespread use to eradicate coca and poppy plants in Colombia and other countries.[31] Colombian agronomists uncovered the use of an additive that reportedly increased herbicide exposures to more than 100 times Monsanto's recommended dosage for conventional agricultural applications, and coca and poppy plants were not the only casualties. U.S. aerial spraying of tons of Roundup over the Colombian countryside destroyed local subsistence crops such as manioc, bananas, palms, sugarcane and corn, poisoned creeks, rivers and lakes, and destroyed indigenous fish populations.

GMOs enter the food chain

Monsanto's aggressive promotion of its biotechnology products, from recombinant Bovine Growth Hormone (rBGH), to "Roundup Ready"-branded soybeans and other crops, to its insecticide-producing varieties of corn and cotton, is a substantial continuation of its many decades of ethically questionable practices. "Corporations have personalities, and Monsanto is one of the most malicious," explains author Peter Sills. "From Monsanto's herbicides to Santophen disinfectant to BGH, they seem to go out of their way to hurt their workers and hurt kids."

In the late 1980s, Monsanto was one of four chemical companies seeking to market a synthetic Bovine Growth Hormone to artificially boost milk production, using genetically engineered *E. coli* bacteria to manufacture the protein hormone. As Jennifer Ferrara described in *The Ecologist's* "Monsanto Files" issue, the company's 14 year effort to gain approval from the U.S. Food and Drug Administration (FDA) to bring recombinant BGH to market was fraught with controversy, including allegations of a concerted effort to suppress information about the hormone's ill effects.[32] One FDA veterinarian, Richard Burroughs, was fired after he accused both the company and the agency of suppressing and manipulating data to hide the effects of rBGH injections on the health of dairy cows.[33]

In 1990, when FDA approval of rBGH appeared imminent, a veterinary pathologist at the University of Vermont's agricultural research facility released previously suppressed data to two state legislators documenting increased rates of udder infection in cows that had been injected with the then-experimental Monsanto hormone, as well as an unusual incidence of severely deforming birth defects in offspring of rBGH-treated cows.[34] An independent review of the University data by a Vermont farm advocacy group documented additional cow health problems associated with rBGH, including high incidences of foot and leg injuries, metabolic and reproductive difficulties and uterine infections. Congressmember Bernie Sanders urged Congress' General Accounting Office (GAO) to investigate, but the agency was unable to obtain the necessary records from Monsanto and the University, particularly with respect to suspected teratogenic and embryotoxic effects. The GAO auditors still concluded that cows injected with rBGH had mastitis (udder infection) rates one third higher than untreated cows, and recommended further research on the risk of elevated antibiotic levels in milk produced using rBGH.[35]

Monsanto's rBGH was eventually approved by the FDA for commercial sale beginning in 1994. The following year, Mark Kastel of the Wisconsin Farmers Union released a study of Wisconsin farmers' experiences with the drug. His findings exceeded the 21 potential health problems that Monsanto was required to list on the warning label. Kastel found widespread reports of spontaneous deaths among rBGH-treated cows, high incidences of udder infections, severe metabolic difficulties and calving

problems, and in some cases an inability to successfully wean treated cows off the drug.[36] Many experienced dairy farmers who experimented with rBGH found they needed to replace large portions of their herd. Instead of addressing the causes of farmers' complaints about rBGH, Monsanto went on the offensive, threatening to sue small dairy companies that advertised their products as free of the artificial hormone, and joining with several dairy industry trade associations to sue the state of Vermont after it passed the first and only mandatory labeling law for rBGH in the United States.[37] Evidence for the damaging effects of rBGH on the health of both cows and people continued to mount, until most leading dairy manufacturers in the U.S. eventually prohibited their suppliers from using the drug and Monsanto sold the rights to rBGH to Eli Lilly's veterinary drug division in 2008.[38]

Monsanto's efforts to prevent labeling of genetically engineered soybean and corn exports from the United States continued the same strategy that sought to squelch complaints against the dairy hormone. While Monsanto still argues that its "Roundup Ready" soybeans reduce herbicide use, crop varieties genetically engineered to withstand chemical weed killers are far more likely to increase farmers' dependence on these chemicals. Weeds that emerge after the original herbicide has dispersed or broken down are often treated with further applications of herbicides.[39] "It will promote the overuse of the herbicide," Missouri soybean farmer Bill Christison told Kenny Bruno of Greenpeace International. "If there is a selling point for RRS, it's the fact that you can till an area with a lot of weeds and use surplus chemicals to combat your problem, which is not what anyone should be doing."[40] Christison refuted Monsanto's claim that herbicide-resistant seeds are necessary to reduce soil erosion from excess tillage, and explained that Midwestern farmers have developed numerous methods of their own to reduce herbicide use.

Defying these concerns, Monsanto stepped up its production of Roundup. After Monsanto's U.S. patent on Roundup expired in 2000, the company's strategy to compete against generic glyphosate products came to increasingly depend upon the packaging of Roundup herbicide together with "Roundup Ready" seeds capable of withstanding repeated herbicide treatments.[41] By the mid-2000s Roundup use on soybeans was increasing by 9 percent every year, and glyphosate-resistant varieties of common weed species began to appear in California and the Midwest. By 2012, more than 20 resistant weed varieties had been identified, reducing some farmers' crop yields by as much as 50 percent.[42] Monsanto's response was to develop new GMO varieties of soybeans and corn with combined resistance to several additional herbicides, including highly volatile, drift-prone dicamba – which has become such a nuisance to neighboring farms that several states have instated partial bans on its use[43] – nd the highly toxic 2,4-D, formerly best known as a component of Agent Orange.

In addition to its herbicide-tolerant varieties, Monsanto has also been at the forefront of genetically engineering varieties of corn, cotton and other crops to a class of bacterial toxins in order to reduce damage from crop pests. The insecticidal toxins, derived from *Bacillus thuringiensis*, have been utilized by organic growers in the form of a freeze-dried bacterial spray since the early 1970s. But while *Bt* bacteria are relatively short-lived, and secrete their toxin in a form that only becomes activated in the alkaline digestive systems of particular worms and caterpillars, genetically engineered Bt crops produce an active form of the toxin throughout the plant's life cycle.[44] Today, many common genetically engineered crops contain a combination of several different herbicide tolerance and Bt toxin-producing traits, a technology known as "gene stacking."

As predicted more than 20 years ago, the presence of Bt toxins throughout a plant's life cycle has encouraged the development of resistant strains of common crop pests. Early on, the EPA determined that widespread resistance to Bt could render natural applications of *Bt* bacteria ineffective and required growers to plant refuges of up to 40 percent non-Bt corn or cotton in an attempt to forestall this effect, a mandate that large growers almost universally ignored. The active toxin secreted by these plants was also found to harm beneficial insects, moths and butterflies.[45]

With all these problems, how did GMOs become so pervasive in U.S. commodity crop production, as well as in several other countries such as Brazil and Argentina? Two reasons stand out in particular. The first is that growers of commodity crops like corn and soybeans are under continual pressure to increase production amidst highly volatile crop prices. The ability to spray crops with chemical weed-killers throughout the growing season has made it easier for farmers to expand their acreage without additional labor costs. Second, and probably more important, is the increasing concentration of ownership of the seed supply by Monsanto and a handful of other GMO producers. By 2015, only seven companies had come to control 71 percent of the global commercial seed supply, including GMO producers Monsanto, DuPont and Dow (now merged), Syngenta, and Bayer. All these companies originally came to the forefront as producers of agricultural chemicals, and many had their origins as producers of nerve gases and other weapons of war.[46] Monsanto has leveraged its increasing control over seed production to limit farmers' ability to choose whether or not to grow GMOs. As public sector research in traditional plant breeding has declined precipitously, Monsanto has become a dominant player in numerous areas of agronomic research. New conventionally-bred traits that are widely sought by growers – affecting crop yields, oil content and nutrition – are now often only available from seeds that also carry genetically engineered traits for herbicide tolerance and Bt insecticide production.

Monsanto started its climb toward becoming the world's largest seed producer in the late 1990s, when they began to acquire ownership of many of the largest, most established seed companies in the

United States. First they bought Holdens Foundation Seeds, supplier of germplasm used on 25-35 percent of U.S. maize acreage, and Asgrow Agronomics, which Monsanto described as "the leading soybean breeder, developer and distributor in the United States."[47] In India, Monsanto took control of the country's flagship seed supplier Mahyco, originally the Maharashtra Hybrid Seed Company. Monsanto also bought De Kalb Genetics, once the second largest seed company in the United States and the ninth largest in the world, and spent more than two years trying to acquire Delta and Pine Land, the largest U.S. cotton seed company, and the developer (together with the U.S. Department of Agriculture), of the notorious "Terminator" seed technology, a genetic intervention that induces plants to produce sterile seeds that could never be successfully replanted.[48] For Monsanto and other GMO producers, this was once perceived as the key to maintain control over GMO patents, but farmer activists and critical scientists saw it as an existential threat to the integrity of the seed supply.

In October of 1999, amidst international public uproar, Monsanto made world headlines with the announcement that it would not seek to market "Terminator" seeds.[49] For Monsanto, this was a small price for salvaging the future of genetically engineered crops. It was almost a textbook case of modern corporate public relations, in which companies are urged to admit mistakes and seek wider credibility by appearing to involve activist groups in corporate decision making.[50] However, Monsanto didn't stop trying to prevent farmers from using their patented GMOs unless they agreed to sign restrictive contracts and pay steep royalties. Instead of engineering sterility into their GMO crops, Monsanto took to the courts and to various extra-legal forms of harassment. As of 2012, the Center for Food Safety had documented 142 lawsuits against 410 farmers in 27 US states, and an additional 4500 investigations of farmers the company accused of "seed piracy," *i.e.* saving or reselling seeds harvested from GMO crops.[51] Most famously, Saskatchewan canola grower Percy Schmeiser faced a Monsanto lawsuit for having replanted his own seed after it apparently cross-pollinated with a neighbor's Roundup-tolerant canola. The Canadian Supreme Court ultimately ruled that Monsanto had the right to sue Schmeiser to protect the company's patent rights, but overturned all the monetary damages that had been imposed by a lower court; Schmeiser didn't use Roundup, and thus had gained no tangible benefit from the herbicide-tolerance trait.[52]

Monsanto further cemented its dominance in global seed production in 2005 when it purchased Seminis Seeds, a Mexican company that had become the premier supplier of vegetable seeds in the Western Hemisphere.[53] By 2015, Monsanto controlled more than a quarter of the world's production and sale of agricultural seeds.[54]

Monsanto's Greenwash

Given this history, it is easy to understand why people around the world refused to trust Monsanto with the future of our food and our health. But Monsanto has gone to great lengths to appear unperturbed by this opposition. Through efforts such as the British advertising campaign that inspired "The Monsanto Files" in response, their involvement with the prestigious Missouri Botanic Garden, and their sponsorship of a state-of-the-art biodiversity exhibit at the American Museum of Natural History in New York in the early 2000s, they sought to appear greener, more righteous and more forward looking than their opponents.

In the U.S. Monsanto and other biotech companies have cultivated close ties to people at the highest levels of every recent presidential administration. In May of 1997, Mickey Kantor, an architect of Bill Clinton's 1992 election campaign and United States Trade Representative during Clinton's first term, was elected to a seat on Monsanto's Board of Directors. Marcia Hale, once a personal assistant to Clinton, served as Monsanto's public affairs officer in Britain.[55] Vice-President Al Gore's Chief Domestic Policy Advisor in the late 1990s, David W. Beier, was formerly the Senior Director of Government Affairs at the pioneering medical biotech company, Genentech.[56] In the George W. Bush administration, cabinet secretaries Donald Rumsfeld (Defense), John Ashcroft (Attorney General), Tommy Thompson (Health and Human Services) and Anne Veneman (Agriculture) all had historic ties, either as officials of companies absorbed by Monsanto or as recipients of large campaign contributions. Rumsfeld, the notorious Iraq war architect, had been the CEO of G.D. Searle pharmaceuticals prior to its purchase by Monsanto in 1985. A few years earlier, he exercised his influence as a leading member of Ronald Reagan's presidential transition team to urge the Food and Drug Administration to approve Searle's artificial sweetener, aspartame (a.k.a. "Nutrasweet"), despite its known neurotoxicity.[57]

Barack Obama's Secretary of Agriculture, former Iowa governor Tom Vilsack, had once been honored as Governor of the Year by the Biotechnology Industry Organization.[58] His term as governor was also noted for the widespread expansion of large-scale factory farms (Concentrated Animal Feeding Operations, or CAFOs), and expanding unsustainable ethanol production from corn. Initially, Obama was praised for his early campaign statements in support of GMO labeling, as well as Michelle Obama's famous organic vegetable plot on the White House lawn and an early antitrust initiative in support of small farmers. However, the administration soon succumbed to an intensive industry lobbying campaign, stepping back from antitrust enforcement and largely abandoning its rhetorical challenges to the corporate food giants.[59] In Obama's second term, Vilsack's USDA initiated an effort to "modernize" the assessment of new GMO crop varieties, which eventually resulted in a proposed rule to limit the scope of new crop trials that fall under the agency's jurisdiction.[60] When Donald Trump moved into the Oval Office in

2017, he appointed Sonny Purdue, a former Georgia governor and agribusiness operator – mainly involved in fertilizers, grain and trucking – as his Agriculture Secretary. Most likely, this will further exacerbate the problem of agribusiness dominance over the mammoth department, which is second only to the Pentagon in its size and scope.

For much of its recent history, however, Monsanto was on the defensive. Several attempts to merge with larger companies – mainly to help pay for the billions spent on seed company acquisitions – had fallen through.[61] Monsanto engaged in merger talks with American Home Products, DuPont, Novartis and several other companies and eventually merged for two years with the pharmaceutical giant, Pharmacia, which spun off a much more agriculturally-focused Monsanto in 2001. Still, the company's aggressive promotion of genetically engineered corn and soybeans had made the name Monsanto synonymous with everything that is threatening and out-of-control about genetic engineering. In 1999, Germany's Deutsche Bank declared genetically modified crops an economic "liability to farmers," advising its investors to stop buying agricultural biotech stocks, and the *Wall Street Journal* announced that Monsanto, once the seemingly invincible world leader in biotechnology, would be worth significantly more to investors if it were to simply be broken up.[62]

Even the smaller and more focused Monsanto that emerged from the Pharmacia merger remained vulnerable. In 2003, when the *New York Times* investigated the growing problem of Roundup resistant weeds, the paper quoted Idaho agronomist Charles Benbrook saying he had been approached to consult with investment bankers considering a purchase of Monsanto in order to break it up.[63] Then, in 2016, following an unsuccessful attempt to purchase the Swiss agrochemical and GMO producer Syngenta, Monsanto agreed to sell itself to the pharmaceutical and agribusiness giant Bayer. The combined company will further monopolize the seed supply, controlling 34 percent of the global herbicide market, 23 percent of insecticides, 29 percent of all seed sales, and close to 60 percent of the world's cotton seeds.[64]

Monsanto also made headlines in the mid-2010s as its efforts to manipulate research results in its favor began to attract more scrutiny. In 2015, the *New York Times* highlighted Monsanto's funding support for horticulturist Kevin Folta of the University of Florida, who travels the U.S. advocating for GMOs.[65] The *Times* reported that many of Folta's talking points were drafted by the Ketchum public relations firm on behalf of the biotech industry. Then in 2017, two decades worth of documents uncovered by attorneys representing cancer patients who had been exposed to Roundup revealed a consistent pattern of payments to scientists on Monsanto's behalf. The documents, stated one of the attorneys,

> show that Monsanto has deliberately been stopping studies that look bad for them, ghostwriting literature and engaging in a whole host of corporate malfeasance. They (Monsanto) have been telling everybody that these products are safe because regulators have said they are safe, but it turns out that Monsanto has been in bed with U.S. regulators while misleading European regulators.[66]

Today, with surrogates for the fossil fuel, chemical, agribusiness, banking and pharmaceutical industries firmly in charge of federal regulatory agencies, the public is increasingly reliant on unofficial sources to reveal those agencies' inner workings.[67] The current deregulatory fervor in Washington may be a boon for mega-corporations like Monsanto, but it is clearly at the expense of those corporations' victims and the public at large.

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